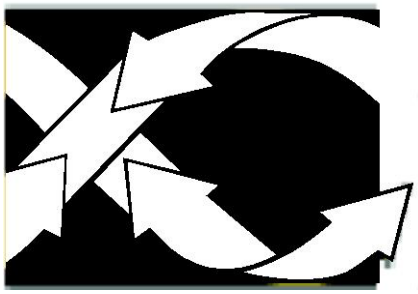


IDeA Networks of Biomedical Research Excellence

Arkansas INBRE Research Conference

2017

October 27-28, 2017

Arkansas INBRE Research Conference

Arkansas IDeA Network of Biomedical Research Excellence

Schedule of Events

Friday, October 27, 2017

12:00 p.m. to 1:30 p.m.	Registration (Chancellor Hotel Atrium, 2nd floor). Graduate Program Information available from 12:00-1:30.
1:30 p.m.	Opening Session, chaired by Professor Surendra Singh, Physics, University of Arkansas. (Chancellor Hotel, Eureka Springs Ballroom)
1:35 p.m. to 3:00 p.m.	Invited faculty presentations
3:00 p.m. to 3:15 p.m.	Set-up time for student orals
3:00 p.m.	Official hotel check-in
3:15 p.m. to 5:00 p.m.	Undergraduate oral presentations (Chancellor Hotel, Biology - Eureka Springs Ballroom; Chemistry – Bella Vista Room; Physics – Petit Jean Room). (12 minute talks with 3 minutes for questions)
5:15 p.m. to 6:15 p.m.	Faculty Discussion Group and Reception (Chancellor Hotel, Lounge and Restaurant, First Floor)
5:15 p.m. to 6:15 p.m.	Student Discussion Group and Reception (Chancellor Hotel, Atrium)
6:30 p.m.	Banquet (Fayetteville Town Center) Your nametag is your ticket in!
7:15 p.m.	Featured Speaker: **Dr. Jun Ye**

Saturday, October 28, 2017

7:30 a.m. to 8:00 a.m.	Poster Set-up begins (Hillside Auditorium)
7:30 a.m. to 10:00 a.m.	Conference Registration (Upper Hillside Lobby)
7:45 a.m. to 9:30 a.m.	Continental breakfast (Upper Hillside Lobby and Physics)
7:45 a.m.	Poster judges receive assignments (Upper Hillside Lobby for Biology, Chemistry) (Physics Building for Physics)
8:00 a.m. to 9:00 a.m.	Poster Session A (Hillside and Physics)
9:00 a.m. to 9:15 a.m.	BREAK – Remove Session A posters. Put up Session B posters. (Note that breakfast ends at 9:30.)
9:15 a.m. to 10:15 a.m.	Poster Session B (Hillside)
10:30 a.m. to 11:45 a.m.	Workshops and Tours (UA Campus, various locations)
11:55 a.m.	Award presentations & conclusion, Hillside Auditorium 202

Registration Information

The INBRE registration desk will be open:

- Friday – 12:00 p.m. to 5:00 p.m., Chancellor Hotel Atrium (2nd floor)
- Saturday – 7:30 to 10:00 a.m., Hillside Auditorium, Upper Lobby

Travel Subsidies are no longer being given.

Lodging will be at the Chancellor Hotel, 70 N. East Avenue, Fayetteville, AR 72701.

Parking: Friday parking is complimentary in the Municipal Parking Garage, third level only (first level card access for registered guests of the Chancellor Hotel). Parking in the parking garage behind the Town Center is free between 12:30 pm and 9:00 pm Friday.

Saturday parking is free on the UA campus in designated yellow-sign lots and parking decks. Please see the map at end of program.

Arkansas INBRE

The Arkansas IDeA Network of Biomedical Research Excellence (Arkansas INBRE) is funded by a grant from the National Institute of General Medical Sciences (NIGMS), under the Institutional Development Award (IDeA) Program of the National Institutes of Health (NIH). The IDeA program was established for the purpose of broadening the geographic distribution of NIH funding for biomedical and behavioral research. Currently NIGMS supports INBRE programs in 23 states and Puerto Rico.

The Arkansas INBRE builds on the successful Arkansas Biomedical Research Infrastructure Network (BRIN) program that was established in 2001 under a grant from NCRR. The Arkansas BRIN established a statewide network that links Arkansas institutions of higher education to establish and maintain a statewide infrastructure in support of growing efforts to build capacity for biomedical research in Arkansas. https://inbre.uams.edu/

Arkansas INBRE Research Conference

The Arkansas INBRE Research Conference is sponsored by Arkansas INBRE and is hosted by the departments of biological sciences, physics, and chemistry and biochemistry, Fulbright College of Arts and Sciences, University of Arkansas.

Conference Planning Committee

Denise Greathouse, chemistry and biochemistry
Ravi Barabote, biological sciences
Leslie Johnson, chemistry and biochemistry
Roger Koeppe, chemistry and biochemistry
Reeta Vyas, physics

INBRE Steering Committee

Lawrence Cornett, UAMS, Director
Helen Beneš, UAMS, Program Coordinator; Associate Director
Stephen Addison, UCA
Galina Glazko, UAMS
Brian Greuel, John Brown University
Teresa Hudson, UAMS, Program Evaluator
Joe Jeffers, Ouachita Baptist University
Roger Koeppe, UAF
Mansour Mortazavi, UAPB
Arijit Mukherjee, UCA
Richard Murray, Hendrix College
Elizabeth Pierce, UALR
Yasir Rahmatallah, UAMS
Malathi Srivatsan, Arkansas State Univ.
Andy Sustich, Arkansas State Univ.
Leslie Templeton, Hendrix College
Jerry Ware, UAMS, PUI Consultant
Andrew Sustich, Arkansas State Univ.
Grant Wangila, UAPB
Jerry Ware, UAMS

Staff

Diane McKinstry, UAMS, Program Coordinator
Caroline Miller Robinson, UAMS, Business Manager
Linda Williams, UAMS, Research Liaison

Biotechnology Core Leaders

Joshua Sakon, UAF
Alan Tackett, UAMS

Poster Session and Awards

Display

Poster set-up begins at 7:30 a.m. Saturday in Hillside Auditorium, Lower Level; and Physics Building.

Session A – 8:00 a.m. to 9:00 a.m.
9:00-9:15 BREAK. Take down Session A posters.
Put up Session B posters.
Session B – 9:15 a.m. to 10:15 a.m.

Presenters are expected to be present during the scheduled time. Business or business casual dress is encouraged. *See index and abstracts in this program for numbers and Session assignments.*

Awards

Prizes will be awarded to the top oral and poster presentations by undergraduate students in each discipline. The awards will be presented Saturday at 11:55 a.m. in Hillside Auditorium Room 202. Presenters must be present at the awards presentation to receive an award.

Judging Rules

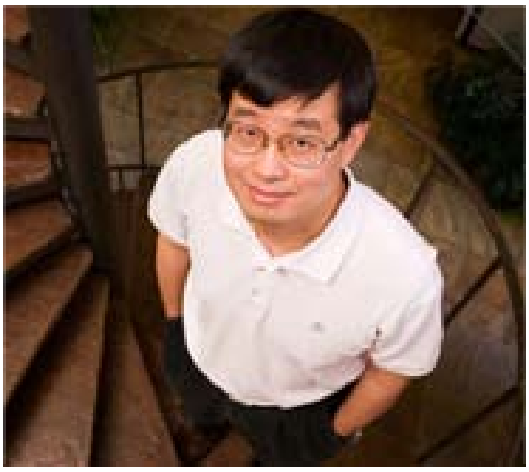
Each undergraduate oral presentation and poster will be judged by at least two judges, selected from various institutions. To avoid a possible conflict of interest, no judge will evaluate a presentation from his/her own institution.

Awards will be given in each of the three disciplines – physics, biology, and chemistry and biochemistry. Only oral talks and posters with undergraduate participation, and where a sole designated presenter is an undergraduate student, will qualify for awards.

Featured Speaker

Optical Atomic Clock and Applications

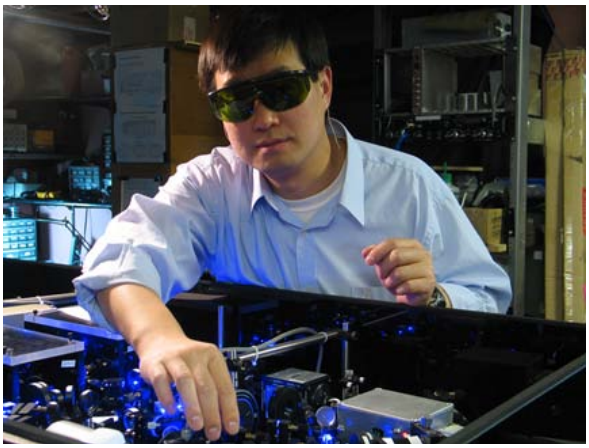
Jun Ye, Ph.D.



Dr. Jun Ye is a Fellow of JILA, a Fellow of NIST, and Professor Adjoint, Department of Physics, University of Colorado, Boulder.

ABSTRACT: Emerging technologies based on quantum state engineering of ultracold matter and precise control of laser field have revolutionized a new generation of atomic clocks with accuracy at the 18th digit. This progress has benefited greatly from microscopic understandings of atomic interactions in the quantum regime and the capability of controlling optical phase coherence over many seconds. The unified front of precision metrology and quantum physics will allow us to explore complex quantum systems, test the fundamental laws of nature, search for new physics, and find unexpected applications.

Jun Ye is a Fellow of JILA, a joint institute of NIST and University of Colorado. He is a member of the National Academy of Sciences, a Fellow of NIST, a Fellow of the American Physical Society, and a Fellow of the Optical Society of America. His research focuses on the frontier of light-matter interactions and includes precision measurement, quantum physics and ultracold matter, optical frequency metrology, and ultrafast science. He has co-authored over 300 scientific papers and has delivered 500 invited talks. Awards and honors include US Presidential Rank (Distinguished) Award, three Gold Medals from the U.S. Commerce Department, Frew Fellowship from the Australian Academy of Science, I. I. Rabi Prize from the American Physical Society, European Frequency and Time Forum Award, Carl Zeiss Research Award, William F. Meggers Award and Adolph Lomb Medal from the Optical Society of America, Arthur S. Flemming Award, Presidential Early Career Award for Scientists and Engineers, Friedrich Wilhem Bessel Award from Alexander von Humboldt Foundation, and Samuel Wesley Stratton Award from NIST. The web page for further information about his research is http://jila.colorado.edu/YeLabs/.



Invited Faculty Presentations

Friday from 1:30 p.m. to 3:00 p.m. (Chancellor Hotel, Eureka Springs Ballroom)

No registration required

Dr. Argelia Lorence, Ph.D.
Professor of Metabolic Engineering
Arkansas State University
(1:35 –2:00)

TITLE: Harnessing the Power of Omic Approaches for Understanding the Role of the Inositol Pathway to Ascorbate in Plant Growth and Stress Tolerance

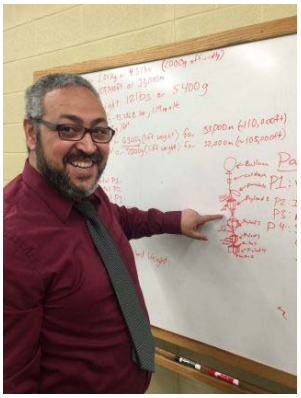
Abstract: Food security is currently one of the major challenges that we are facing as a species. Understanding plant responses and adaptations to abiotic and biotic stresses is key to maintaining and improving crop yields, and this is even more critical considering the different projections of climate change. Vitamin C (L-ascorbic acid, AsA) is a major antioxidant that modulates multiple developmental and defense responses in plants. This small molecule also plays a key role at protecting plant tissues against the damage caused by reactive oxygen species. In plants, ascorbate is synthesized by a complex metabolic network and, transcriptional profiling studies in multiple plant species suggests that the AsA pathways may differ in their responsiveness to stresses, but their relative contributions to stress adaptation are not yet fully understood. We have demonstrated that engineering high ascorbate in Arabidopsis and rice leads to plants with enhanced growth rate, biomass accumulation, and tolerance to multiple abiotic stresses including salinity, heat, cold, water limitation, and environmental pollutants. In this work we are leveraging genomics, transcriptomics and phenomics approaches to elucidate the mechanisms behind the enhanced growth phenotype we have observed in our high AsA Arabidopsis lines. We will also present our progress on the characterization of a new gluconolactonase (GNL) in plants. This is the third enzyme involved in the conversion of myo-inositol to ascorbate. Eighteen putative GNLs were identified in Arabidopsis, one of which, AtGNL, possesses a chloroplastic signal peptide. Chloroplasts can accumulate up to 50 mM AsA but until now no chloroplastic AsA biosynthetic genes have been described. We have characterized the first plant GNL enzyme in vitro and in planta. Knockouts on this gene had lower foliar vitamin C and stunted growth compared to controls. The functional gene restored the phenotype of the knockouts, and those plants had higher AsA content, and enhanced photosynthetic capacity and seed yield. Next steps in this research include testing the effect of the constitutive expression of this GNL gene in crop plants.

Dr. Mauricio Cafiero, Ph.D.
James H. Daughdrill Professor and Chair
Dr. Larryn Peterson, Ph.D.
Assistant Professor

Department of Chemistry
Rhodes College
(2:05 – 2:30)

TITLE: Novel Inhibitors of Enzymes in the Dopamine Pathway: Modelling and Synthesis

Abstract The many enzymes involved in the metabolism of dopamine have similar substrates, making the design of selective ligands or inhibitors for specific enzymes difficult. This project entails the design, computational analysis, synthesis, and testing of a library of compounds for their ability to inhibit a suite of enzymes involved in the dopamine pathway. The compounds in our library start with a basic catecholaminic core, with various groups added the aromatic ring and substitution of neutral and charged moieties for the ethylamine tail. The crystal structures for the enzymes catechol-O-methyltransferase (COMT), DOPA decarboxy-lase, monoamine oxidase B, aldehyde dehydrogenase, phenylalanine hydroxylase, and tyrosine hydroxylase were obtained from the protein databank. Our novel ligands were placed in the active site in an initial confirmation similar to experimentally bound ligands. The structures were then optimized using the M062X or M06L methods with the 6–31+G*basis set including implicit solvation and relaxed ligand side chains. Interaction energies between each optimized ligand and the active site were then calculated with the same methods and the 6–311+G* basis set. Desolvation effects on the ligands were also taken into account. Several of the ligands from our library have been synthesized and tested experimentally in an enzymatic assay with COMT. These results have been correlated with the computational results to design more selective inhibitors in the future.



Dr. Abdel Bachri, Ph.D.
Chair, Engineering and Physics Department
Interim Dean, College of Science and Engineering
Southern Arkansas University
(2:35 – 3:00)

TITLE: Suppression of Radiation-induced Chromosome Damage by γ-Tocotrienol (GT3) and the Role of Microgravity

Abstract: One of the major risks during manned space mission is combined exposure to ionizing radiation (IR) and microgravity. IR generates reactive oxygen species which cause DNA double-strand breaks (DSBs) that are responsible for cytogenetic alterations, known to associate with cancer and cardiovascular disease, two major causes of death. We measured DSB formation in irradiated primary human umbilical vein endothelial cells (HUVECs) by quantifying the formation of γ-H2AX foci. Chromosomal

aberrations (CAs) were analyzed in irradiated HUVECs and in the bone marrow cells of irradiated mice by conventional and fluorescence-based chromosome painting techniques. Gene expression was measured in HUVECs with quantitative reverse transcriptase polymerase chain reaction (qRT-PCR). We find that pretreatment with vitamin E isoform γ-tocotrienol (GT3) reduced DSB formation in HUVECS, and decreased CAs in HUVECs and mouse bone marrow cells after irradiation. GT3 should be explored as a therapeutic to reduce the risk of developing genetic diseases after radiation exposure. Furthermore, no systematic study has been undertaken to investigate whether microgravity differentially modulates the expression of endothelial dysfunction markers in irradiated endothelial cells. To gain insight into this we subjected human endothelial cells under simulated microgravity after exposure to Ionizing Radiation. To simulate a low shear microgravity environment, endothelial cells were grown on micro-carrier beads and subsequently subjected to a rotary culture systems. We observed microgravity induces morphological changes in endothelial cells and enhances radiation-induced endothelial cell killing. In addition, IR plus microgravity causes differential expression of E-selectin, Pecam1, Vcam1, Vegf, and Icam1 than IR alone. These results suggest that microgravity modifies the effect of Ionizing Radiation on endothelial cells.

Participating Institutions

Arkansas State University
Arkansas Tech University
Central Baptist College
Harding University
Henderson State University
Hendrix College
John Brown University
Lyon College
Missouri Southern State University
Missouri State University
Northeastern State University
Northwest Arkansas Community College
Ouachita Baptist University
Philander Smith University
Pittsburg State University
Rhodes College
Southern Arkansas University
University of Arkansas at Fayetteville
University of Arkansas at Fort Smith
University of Arkansas at Little Rock
University of Arkansas at Monticello
University of Arkansas for Medical Sciences
University of Arkansas at Pine Bluff
University of Central Arkansas
University of Missouri
University of the Ozarks

Student Oral Presentations

Undergraduates will give 12-minute oral presentations from 3:15 p.m. to 5:00 p.m. on Friday. All talks will take place at the Chancellor Hotel. Students were chosen based on abstracts and willingness to present an oral platform talk. Additional information, authors, and footnotes can be found in the complete list of abstracts in this program.

Biology Oral Presentations

(Eureka Springs Ballroom)
Tim Evans, Chair

Joe Tolar, Harding University
(3:20 p.m.) Investigation of Non-Canonical Activation of p38 During Endoplasmic Reticulum Stress

Daniel N. Games, Ouachita Baptist University (3:35 p.m.) Visualizing Gamma-herpesvirus Replication Using Viruses that Encode Fluorescently Tagged Proteins

Yari Mosley, University of Arkansas at Pine Bluff (3:50 p.m.) Genetic Dissection of the Neural Circuit Underlying Cold Nociceptive Behavior

Julio Molina-Pineda, University of the Ozarks (4:05 p.m.) Antioxidant Carbon Antioxidant Carbon Nanoparticle Results in Novel Auditory Response in Mice

Ethan Chernivec, University of Central Arkansas (4:20 p.m.) Exploring the effect of rotenone – an inducer of Parkinson's disease – on mitochondrial dynamics in Dictyostelium discoideum

Moira Murdoch, Hendrix College
(4:35 p.m.) qPCR Analysis of Hippocampal Oxidative Stress in Mice Treated with Cranial Radiation and Sulforaphane

Chemistry and Biochemistry Oral Presentations (Bella Vista Room)

Suresh Kumar Thallapuranam, Chair

Jason Lam, University of Arkansas at Monticello (3:20 p.m.) Medium Throughput Extraction of Nanocellulose from Cellulose

Alison Luscomb, University of Arkansas at Fort Smith (3:35 p.m.) Synthesis of Functionalized Nanocages for Engineering Nanoscale Stem Cell Scaffolds

William R. Hayes, Hendrix College
(3:50 p.m.) Design of an Open-Source Stopped-Flow Absorption Spectrometer

C. Skyler Cochrane, Rhodes College
(4:05 p.m.) Design, Synthesis, and Affinity of Dopaminergic Derivatives in SULT1A3

Mallory Bryant, Harding University
(4:20 p.m.) Identifying the Structure of Fat Mobilizing Substance (FMS-1) Associated with Congenital Lipodystrophy

Taylor Hammonds, University of Arkansas at Pine Bluff (4:35 p.m.) Effect of Novel Compounds on Hydrogen Peroxide-Induced Cataract Formation in Cultured Bovine Lenses

Physics Oral Presentations

(Petit Jean Room)
Hugh Churchill, Chair

Kassey Cole, Southern Arkansas University
(3:20 p.m.) Suppression of Radiation-Induced Chromosome Damage by vitamin E Gamma-Tocotrienol

Mercedes Winfrey, University of Arkansas at Pine Bluff
(3:35 p.m.) A Study of Hybrid Electric Propulsion Solutions for Short Range Commuter Operations

Nathan Flood, Pittsburg State University
(3:50 p.m.) Noise Hunting: Mitigating Noise Sources in Virgo pre-O2

Sophia McKinney, Southern Arkansas University
(4:05 p.m.) Dynamic Response of Yeast Cells using Automated Microfluidic Devices

Phoebe Sharp, Rhodes College
(4:20 p.m.) Ultrasonic bone assessment using a time domain analysis of backscatter signals from cancellous bone

Austin Bollinger, Missouri State University
(4:35 p.m.) Molecular Dynamics Simulations of Layered Metallic Systems

Saturday Workshops

INBRE participants are expected to attend a workshop as part of the program. All workshops and tours will take place Saturday at 10:30 a.m., in various locations on the University of Arkansas Campus

Registration for Workshops will be at Conference Registration Table

Workshop 1 – Preparing for Graduate School

(Chemistry Building, Room 132)
Denise Greathouse, PhD, UAF
This workshop is targeted toward undergraduate students who are considering graduate school as a pathway to a career. Topics to be discussed will include graduate school expectations and how to prepare for and select the right graduate school and program for you. A panel of faculty and graduate students will be available to share their tips, strategies, insights, and practical advice. We conclude with a Question and Answer session, with the possibility of breaking out into smaller groups based on specific interests.
Panelists:
David McNabb, Ph.D., Biological Sciences, Chair-Graduate Studies Committee, UAF
Colin Heyes, Ph.D., Chemistry and Biochemistry, Chair-Graduate Studies Committee, UAF
Joseph B. Herzog, Ph.D., Physics, UAF
Adnan Ali Khalaf Alrubaye, Ph.D., Associate Director, Cell and Molecular Biology, UAF
Jerry Ware, Ph.D., Physiology and Biophysics, UAMS
Malathi Srivatsan, Ph.D., Professor of Neurobiology, ASU, Director-Molecular Biosciences PhD program
Matthew Moudy, Senior Graduate Student, Chemistry, UAF
T. Ryan Rogers, Senior Graduate Student, Chemistry, UAF

Workshop 2 – Molecular Modeling

(Chemistry Building, Room 308)
Peter Pulay, PhD, Dept of Chemistry and Biochemistry, UAF
Limited to 12 participants or groups. If feasible, bring a computer, although this is optional.
Methods of molecular modeling on a personal computer will be addressed, with software available for distribution to up to 12 individuals or cluster teams.

Workshop 3 – Intro to Linux for Scientists

(Gearhart Hall, Room 101 computer lab)
Philip Hudson Williams, PhD,
Bioinformatics Tech Director, UA-Little Rock
Limited to 30 participants
Some computer applications for engineering and bioinformatics are only available for the Linux operating system. Linux is an open source operating system (OS) that can be downloaded and installed at no cost. Linux has a large community of developers and support infrastructure. Most high-performance computers (HPC) use the Linux OS, including systems at UA Little Rock, UA Fayetteville and other institutions. In this hands-on workshop,

directory structure, path concepts and file permissions will be demonstrated.

Workshop 4 – Introduction to Synchrotron X-ray Science and Characterization

(Chemistry Building, Room 144)
Robert Coridan, PhD, Assistant Professor of Chemistry and Biochemistry, UAF
X-rays can be used to characterize a multitude of physical, chemical, biological, and materials systems. Synchrotrons are large-scale facilities that provide brilliant x-ray sources for developing the state-of-the-art for these characterization methods. In this workshop, we will discuss how synchrotrons work and explore the types of measurements they enable.

Workshop 5 – Physics "Brain Science Workshop"

(Physics Building, Room 133)
Woodrow Shew, PhD, Associate Professor of Physics, UAF
Limited to 30 participants
We will begin with a brief introduction to how large networks of neurons are responsible for our thoughts, perceptions, and actions. Then we will have a fun brain trivia match and a "mind control" contest using the electrical signals of your own brain against your opponent's brain. Don't worry, it all will be quite safe.

Workshop 6 – Physics "Super-Resolution Fluorescence Microscopy"

(Physics Building, Room 134 and 115A)
Yong Wang, PhD, Assistant Professor of Physics, UAF
Limited to 15 participants.
This workshop will briefly introduce the basics of super-resolution fluorescence microscopy based on single-molecule localization, which improves the spatial resolution of light microscopy from ~300 nanometers to ~20 nanometers (see 2014 Nobel Prize in Chemistry for more details). Attendees will have a chance to image an important universal regulatory protein – HNS – in *E. coli* bacteria, to localize individual HNS molecules, and to produce super-resolved images of HNS proteins in *E. coli* with a resolution of ~ 20 nanometers.

Workshop 7 – Physics: "A 2D How-to"

(Nano Building, Room 105)
Hugh Churchill, PhD, Professor of Physics, UAF
Limited to 15 participants.
After a brief introduction to the field of 2D material research, I will demonstrate the now-famous "Scotch tape technique" that is used to peel apart atomically thin layers of graphene and many other 2D materials from 3D crystals. Workshop attendees will then have the opportunity to try this themselves using tape, tweezers, and silicon chips, followed by "flake hunting" with a microscope.

Workshop 8 – Physics "Graduate Application"

(Physics Building, Room 132)
Reeta Vyas, PhD, Professor of Physics, UAF
Limited to 20 participants

Participants will learn about career options for physics graduates, dos and don'ts of the application process for Physics Graduate Programs in the US – importance of and preparation for GRE, course work, recommendation letters, assistantships, etc.

Workshop 9 – Cellular Mechanisms of Salt and Water Transport in Fish

(Ferritor Building, Room 317)
Christian Tipsmark, PhD, Associate Professor of Biology, UAF
The goal of physiological research is to understand the function of living systems from the level of the whole organism and its organs to that of the single cells and bio-molecules. This workshop highlights mechanisms and regulation of salt and water transport in fish and demonstrates some of the methods used in physiology. It will cover experimentations with whole animals and isolated tissues. Techniques demonstrated will include enzyme assays, specific mRNA and protein quantification and cellular localization of specific proteins with immunofluorescence.

Workshop 10 – STEAM-H: Collaborate, Innovate, and Inspire your Community (Nano Atrium)

Shilpa Iyer, PhD, Biology Department.
Limited to 30 participants.
This workshop will engage participants in the power of integrative STEAM-H (Science, Technology, Engineering, Architecture/Arts, Mathematics, and Health) approaches to communicate significant public health concerns related to mitochondrial and obesity-related disorders.

Abstracts

Presentations are posters, on Saturday, unless denoted as "**Oral**" for Friday afternoon.

Biological Sciences

Friday Oral Platform Session

ORAL – 3:20. **Investigation of Non-Canonical Activation of p38 During Endoplasmic Reticulum Stress.** Joe Tolar, Jay Brewster. *Biology, Harding University, Seracy, AR 72143.*

In all eukaryotic cells, stress signaling from the endoplasmic reticulum (ER) plays a critical role in cellular adaptation and in the maintenance of homeostasis. Severe disruption of ER function can induce dramatic changes in cellular behavior or even apoptosis (cell suicide). This study evaluates stress signaling from the ER resident signaling kinase known as PKR-like ER kinase (PERK). Prior work in our lab has shown PERK to play an essential role in the activation of apoptosis during ER stress. Downstream of PERK activity is the stress-activated kinase, p38, whose activity is required for apoptosis activation during some forms of ER stress. The mechanism of PERK and p38 interaction is not well understood. Heat Shock Protein 90 (HSP90) is a cytosolic chaperone that binds to inactive p38. Release of p38 from HSP90 is known to enable autoactivation of this kinase. In this study, we used hamster kidney fibroblasts (BHK21 cells) in cell culture to evaluate ER stress signaling. Inhibition of HSP90 (17-AAG treatment) was sufficient to induce phosphorylation of p38 on threonine 180 (T180), a marker of p38 activation. When the timing of this activation was evaluated, 17-AAG was shown to induce p38 within 5 minutes of exposure and to continue for approximately 30 minutes. Tunicamycin, an activator of ER stress, caused an activation of p38 along a similar pattern of 5-30 minutes. To examine if ER stress was sufficient to induce p38 dissociation from HSP90, immunoprecipitation assays were used. Cells overexpressing p38 (FLAG-tagged) were lysed and an anti-FLAG antibody used to pull p38 down from the lysate. HSP90 co-immunoprecipitated with p38, and this association was diminished by either HSP90 inhibition or ER stress activation. Assessment of the dependence of PERK activity upon stimulation of p38 release is ongoing and will be discussed.

ORAL – 3:35. Visualizing Gammaherpesvirus Replication Using Viruses that Encode Fluorescently-Tagged Proteins. Daniel N. Games, *Department of Natural Sciences, Ouachita Baptist University, Arkadelphia, AR 71998* and Craig Forrest, *Immunology and Microbiology, UAMS, Little Rock, AR 72205.*

Gammaherpesviruses (GHVs) are enveloped viruses that contain a double-stranded DNA genome. They are associated with lymphoproliferative diseases and malignancies. GHVs undergo two distinct phases of infection, lytic replication and latency. During the lytic phase, full viral gene expression occurs and new virus is produced. During latency, viral gene expression is restricted and the virus maintains itself as an episome in the host cell nucleus. Because of their capacity to establish latency, infection by herpesviruses persists for the life of the infected host. A human GHV, Kaposi sarcoma-associated herpesvirus (KSHV) is difficult to study in vivo because it is species restricted. As an alternative approach to understand the mechanism of GHV pathogenesis, we use a related murine herpesvirus, murine gammaherpesvirus 68 (MHV68) to study GHV infection in a small animal model. Our understanding of GHV infection is incomplete, and the goal of the project was to develop and characterize tools to aid in understanding infection. ORF59 is a DNA processivity factor, which is only expressed when the virus is undergoing acute replication. I characterized modified MHV68 and KSHV viruses that encode a green fluorescent protein (GFP) fused to ORF59. The fluorescence enables visualization of lytic infection, in particular, assembly of viral replication complexes, in real time. We characterized viral growth, in vitro, by comparing ORF59-GFP MHV68 to wild type MHV68. We observed fluorescence in nuclei of ORF59-GFP MHV68 infected fibroblasts, confirming viral infection and correct localization of the fluorescently tagged-protein. We imaged infected cells over an eight-hour and a twenty-hour time course to visualize the spread of infection. Overall, this novel fluorescently-tagged virus is a powerful tool to visualize GHV infection and dissemination.

ORAL – 3:50. Genetic Dissection of the Neural Circuit Underlying Cold Nociceptive Behavior. Yari Mosley, Atit Patel, Daniel N. Cox. *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Do Class III dendritic arborization neurons play a major role in detection and response to noxious cold stimuli? Which interneurons are responsible for the cold evoked behavior? Class III neurons are specifically connected to motor neurons on the outer body wall of Drosophila larvae, contributing to the hypothesis that these neurons are integral for nociceptive cold response. However while it has been extensively studied the impact of Class I, II, and IV systems on nociception, Class III neurons have not been studied in this capacity before. To test this hypothesis, we completed 100 crosses of Gal4 driver males with UAS-TNT-E2 virgin females (Tetanus Toxin variant), to produce 30 larvae per cross that should carry an inhibitory gene, causing the Class III and bordering motor neurons to disconnect. These crosses resulted in at least 12-15 out of each group of 30 larvae to not exhibit usually contraction behavior when exposed to temperatures of 5 degrees Celsius and below (noxious cold). Removing the connection between Class III and motor neurons resulted in the animal not contracting in response to cold, providing evidence consistent with the hypothesis, that Class III neurons are important for cold nociceptive responses. In relation to previous studies done on noxious heat response, a similar variant was used on Class IV neurons to test importance to usual rolling response, providing evidence supporting Class IV neurons integral position. However, the result given in the current experiment could be because of outside stimuli affecting the larvae, such as dryness, moistness, vibrations, or light. These recent discoveries in the development of the Drosophila larval neurological system, provide important insight into human neurological morphology and development.

ORAL – 4:05. Antioxidant Carbon Nanoparticle Results in Novel Auditory Response in Mice. Julio Molina-Pineda, *Biology Department, University of the Ozarks, Clarksville, AR 72830,* and Fred A. Pereira, *Huffington Center on Aging, Baylor College of Medicine, Houston, TX 77030.*

Deafness is a common side effect in people undergoing chemotherapeutic treatment with Cisplatin, a chemical proven to be ototoxic due to its oxidative damage that results in disturbance of the endocochlear potential. An antioxidant carbon nanoparticle has been found to protect the ear from such damage and to enhance auditory response as well. Two experiments were performed: one in which the nanoparticle dosage and its effects were investigated by studying the effect of three continuous doses. And a second experiment in which the inner ear and brain potassium channelâ€™s mRNA expression was compared between nanoparticle treated and untreated mice. Preliminary findings suggest that the nanoparticle increases and delays auditory response, and that higher dosage helps in maintaining the enhancement rather than increasing it. Furthermore, the mRNA analysis suggests a possible mechanism for the enhancement caused by the nanoparticle.

ORAL – 4:20. Exploring the effect of rotenone - an inducer of Parkinson's disease - on mitochondrial dynamics in Dictyostelium discoideum. Ethan Chernivec, Avery Rasberry, Kari Naylor. *Biology, University of Central Arkansas, Conway, AR 72035.*

Parkinson's disease is a major problem in the United States and according to the CDC it is steadily increasing. Parkinson's has an economic cost of 6 billion dollars per year with at least 500,000 cases in the U.S along with 50,000 new cases appearing each year. Currently treatments for neurodegenerative diseases do little to stop the progression of the disease, they only treat symptoms. This drives the need for research into the mechanisms of the onset and progression of all neurodegenerative disease. Rotenone is a known inducer of Parkinson's disease; therefore our goal is to use rotenone to develop a single cell model Parkinson's disease system to better study the disease at a cellular level. Mitochondrial dynamics have been linked to multiple neurodegenerative diseases and several studies have shown that depolymerization of microtubules leads to neural degeneration with loss of dynamics occurring prior to the degeneration. We have developed a mitochondrial dynamic model in the amoeba Dictyostelium discoideum and therefore are pursuing our Parkinson's disease model in the same organism. We are currently in the process of identifying the effects of rotenone on D. discoideum, this project focuses on the effect of rotenone on fission, fusion, and motility. We postulate that rotenone will destroy the microtubules and therefore disrupt mitochondrial dynamics. D. discoideum was treated with 150uM rotenone, the LD50 in these cells, and to confirm specificity of rotenone the effect was reversed with 2mg/ml ascorbic acid. Using laser scanning confocal microscopy it becomes apparent that rotenone increases the velocity of mitochondria movement and inhibits mitochondrial fusion but not fission. Ascorbic acid experiments are currently in progress.

ORAL – 4:35. **qPCR Analysis of Hippocampal Oxidative Stress in Mice Treated with Cranial Radiation and Sulforaphane.** Moira Murdoch, *Biology, Hendrix College, Conway, AR 72032* and T.C. Alexander, F. Kiffer, K. Krager, J. Wang, and A.R. Allen, *Dept. of Pharmaceutical Sciences, UAMS, Little Rock, AR 72205.*

Acute Lymphoblastic Leukemia (ALL) is the most common cancer in children, accounting for almost one-third of juvenile cancer patients. Over the past 50 years, rational use of chemotherapy as well as radiation and CNS-directed therapies has improved survivorship from 10% to 90%. Though the survival rates for ALL are high, up to a quarter of these children are left with hippocampus-related neurocognitive deficits as a result of cranial radiation therapy. This cognitive decline from treatments can affect quality of life for years after cessation of treatment, so it is imperative that studies investigate possible mechanisms that contribute to these symptoms. Oxidative stress constitutes a central mechanism of radiation-induced tissue damage. The brain is the most susceptible organ to oxidative injury because the oxygen consumption rate and metabolic turnover are relatively high and the level of endogenous antioxidants relatively low. Studies show that sulforaphane, which upregulates antioxidant response elements, is able to cross the blood-brain barrier, leading us to conclude that sulforaphane could be a candidate for preventing oxidative stress damage in the brain. Behavioral results from our Y-maze paradigm indicate that mice that received cranial radiation had impaired short-term memory while those that were treated with radiation and sulforaphane were not impaired. The aim of the current study is to determine a possible mechanism through which sulforaphane is able to prevent oxidative damage in the brain through studying 84 oxidative stress genes. Quantitative PCR analysis indicated that sulforaphane up-regulates several oxidative stress genes with a role in neuroprotection.

Biological Sciences
A – Saturday 8:00 – 9:00 Posters
B – Saturday 9:15 – 10:15 Posters

1A. The Role of Cela 1 in α-1 Antitrypsin Sufficient Emphysema. Jana Lewis, Brian Varisco, Rashika Joshi, Qiang Fan, *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Cela 1 is a pancreatic digestive enzyme, expressed in the lungs, that breaks down elastin. It is neutralized by alpha-1-antitrypsin, which protects the elastic structures of the lungs. While we know that A1AT deficiency leads to Cela 1 mediated airspace destruction, we wished to test whether Cela 1 mediates tissue destruction in the localized stretch of airspaces in AAT-sufficient emphysema. To test this, we examined the lungs of wild type mice and mice who had the Cela 1 gene knocked out, all of which were AAT-sufficient, under a microscope. Our results showed that Cela 1 does not play an important role in AAT-sufficient airspace destruction in the murine PPE model of emphysema, as it does not protect against emphysema. In addition, AAT does not appear to be important in air destruction in this model.

1B. The effect of temperature on the stability and prevalence of the symbiosis between the social amoeba D. discoideum and Burkholderia bacteria. Rajheme Brown, Temilolu Adesanya, Tammy Haselkorn, *Biology, University of Central Arkansas, Conway, AR 72035.*

Symbiosis is a relationship between two or more organisms living together, which can be mutualistic, beneficial or parasitic, and can dramatically affect the ecology and evolution of both organisms. Specifically, we are interested in the symbiotic relationship between the soil dwelling amoeba Dictyostelium discoideum and Burkholderia. Previous studies have showed that Burkholderia is beneficial to D. discoidieum as it allows the amoeba to farm. This farming phenomenon allows the amoeba to carry bacteria in their spores as a food source that enables them to grow their own food when dispersed into conditions where the food source is low. Symbionts have been known to have multiple effects on their host, and it is unclear how else Burkholderia may be affecting D. discoideum. Temperature is an important factor that can affect the dynamics of many symbioses, in some cases it can destabilize the relationship, but in other instances some symbionts can even confer thermotolerance to their host. In our study, we investigated the effect that temperature will have on the growth and the ability of Burkholderia-infected D. discoideum to carry food bacteria by growing four different strains of D. discoidieum infected with Burkholderia at 70Âº F and 83Âº F and measuring spore production and farming ability. Preliminary results suggest that farming ability is stable at 83Âº F, and we are now testing higher temperatures and additional strains of Burkholderia. In addition to this, we have collected D. discoideum from the wild in the summer (July) and will be collecting D.discoideum in the fall (November) to compare the prevalence of Burkholderia and its correlation with temperature in nature. This will further allow us to investigate the effect of temperature on the amoeba-bacteria symbiosis in different seasons of the year.

2A. Plant Cell Secreted Growth Factors Targeted to Ex Vivo Production of Red Blood Cells from Hematopoietic Stem Cells. Taylor Hill, Jianfeng Xu, Xiaoting Wang, *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Ex vivo production of red blood cells from hematopoietic stem cells used for blood transfusion represents one of the focuses in regenerative medicine. However, production of red blood cells demands significant quantity and high quality of growth factors, which makes manufacturing at large scale cost prohibitive. Human stem cell factor is a key growth factor that stimulates the proliferation and differentiation of hematopoietic stem cells to red blood cells. My project aims towards producing the human stem cell factor with the plant cell culture technology, which has been presented to be a propitious bioproduction platform for therapeutic proteins, because of its significant advantages in cost and safety over other eukaryotic production systems. However, low protein productivity and particularly low secreted protein yield is a common blockage towards commercialization of this production platform. In addressing this problem, the human stem cell factor was expressed in plant cell with a hydroxyproline (Hyp)-O-glycosylated peptide (HypGP) that presumably functions as a molecular carrier in promoting efficient transport of the conjoined recombinant protein into the culture media and protecting the protein from proteolytic degradation, which ultimately boosts the secreted protein yield. In this study the human stem cell factor was expressed in tobacco BY-2 cell with a HypGP carrier comprised of 20 tandem repeats of â€œAla-Proâ€ dipeptide motif or (AP)20 at either N-terminus or C-terminus. High expression BY-2 cell lines were screened by Dot Blotting. The produced human stem cell factor fusion proteins were characterized by Western Blotting. Finally, the kinetics of plant cell growth and human stem cell factor accumulation in culture media and inside cells were determined over a 14-day growth cycle. Up to 10.5 mg/L of secreted recombinant protein was harvested This research may provide a promising plant cell-based platform to produce large quantity of hematopoietic stem cells that assists the stem cell research and clinical applications.

2B. Water quality assessment at the Grand Prairie Farming & Water Company irrigation system. Donae' Poindexter, *Biology, UA Pine Bluff, Pine Bluff, AR 71601. Oluwayinka Iseyemi, Arlene AdvientoBorbe, Deborah Leslie, Delta Water Management Research Unit, United States Department of Agriculture-Agricultural Research Service, Jonesboro, AR 72401.*

Freshwater is imperative for the survival of all living organisms. Water quality monitoring is essential in recognizing any current or future harm to humans and the environment. Agronomic practices such as adequate fertilization and minimal soil disturbance aid in ensuring reduced environmental pollution. To assess water quality dynamics at the Grand Prairie (GP) Farms, Arkansas, grab water samples were collected from nine locations and analyzed for N concentrations, pH, hardness, alkalinity, turbidity, and electrical conductivity. Water samples were retrieved from the source inlet, water outlet, and seven commercial rice fields daily from 30 May to 21 June 2017. Ammonium (NH4+), nitrate (NO3-) and nitrite (NO2-) concentrations were measured using standard colorimetric methods for nitrogen. Other water quality parameters, pH, hardness, alkalinity, turbidity, and conductivity, were measured using lab instruments and standard methods. Concentrations of NH4+, NO32-, and NO2- across all

locations and sampling dates were <4 mg L-1. Nitrogen concentrations were lower when compared to the regulated limit for ambient surface water. Water pH in all sites ranged between 6-6.9, while hardness and alkalinity were <50 mg L-1. Overall, these findings suggest that surface water moving through the GP farms is categorized as soft with a very low buffering capacity for potential pollution.

3A. SNP Association to Ascites for LRRTM4 Gene on Chromosome 22 in Broiler Chickens. Christa Jackson, *John Brown University, Siloam Springs, AR 72761*, Shatovisha Dey, Alia Parveen, Douglas Rhoads, *Cell and Molecular Biology, University of Arkansas, Fayetteville, AR 72701.*

The goal of this project is to determine the relative contributions of a gene region on chromosome 22 to the development of ascites in broiler chickens. Ascites is leakage of serous fluid into the peritoneum. Ascites results from an inability of the heart and lung to deliver sufficient oxygenated blood to the body. Whole genome resequencing data on a broiler line has identified 31 regions of the chicken genome potentially linked to ascites. This research project focused on a region of chromosome 22 that overlaps the 5' region of the LRRTM4 gene. The LRRTM4 gene plays a role in synaptic development but association studies in humans have indicated this gene may be associated with hypertension and blood pressure. An exonuclease qPCR assay was developed and validated for genotyping for a pair of SNPs (Single Nucleotide Polymorphisms) near 3.85Mbp on chromosome 22. Application of this assay to over 1200 DNA samples indicated a significant association (P=0.047) of this region with ascites susceptibility in female birds. Previously, our group had demonstrated a significant association of the CPQ gene with male resistance. The combined genotype data demonstrated a significant epistatic interaction (P=0.033) for ascites resistance in males. LRRTM4 gene expression was evaluated but did not vary with genotype. Therefore, the effect of this gene on ascites may relate to differences in the protein produced. These genes may now be used in breeding programs for selection for increased resistance to ascites.

3B. Impact of Coxiella burnetii infections on host gene and protein expression in THP-1 cells. Nathan Jacobs, Christa Jackson, Joel Funk, *Biology, John Brown University, Siloam Springs, AR 72761*.

Coxiella burnetii is a pathogenic species of bacteria that infects its host by living within a parasitophorous vacuole (PV) inside the host cell. The bacteria enters a cell through endocytosis and the endosome subsequently fuses with a lysosome to form the PV in which the C. burnetii lives and reproduces. C. burnetii commonly infects livestock, though it has been known to infect humans causing flu-like symptoms that can occasionally be fatal. The purpose of this research is to further understand the changes in gene expression during C. burnetii infections of THP1 cells, especially genes involved in protein kinase C (PKC) cell signaling. We previously characterized the expression of Myristoylated Alanine-Rich C-Kinase Substrate (MARCKS), a PKC substrate that is phosphorylated during C. burnetii infections. In the current study we determined that a related protein, MARCKSL1, also showed increased protein expression and phosphorylation during the infection. In addition, we expanded this study to determine the expression levels of other genes that may be involved in cell signaling during C. burnetii infections using western blotting and real time PCR analysis. Our results indicate C. burnetii possesses the ability to directly affect the biology of the host cell by changing expression of specific proteins.

4A. Glucose enrichment extends the stress resistance of wild-type and daf-2 C. elegans, but only early in life. Michael Byram, Lauren Smith, Mindy Farris. *Biology, University of Central Arkansas, Conway, AR 72035.*

Caenorhabditis elegans are nematodes that are non-hazardous, non-pathogenic, and non-parasitic. It is a widely used model organism because it shares many essential biological characteristics with more complex animals, including humans. This similarity is useful when studying mutations in conserved pathways and how they affect lifespan when stressed. A mutation in daf-2, encoding the only insulin receptor in C. elegans, extends the C. elegans lifespan to almost double its normal level, and also confers some resistance to stressors, such as heat. Glucose, on the other hand, shortens the C. elegans lifespan overall, but has a complex effect on stress resistance. When exposing C. elegans to heat stress, the daf-2 mutant animals are expected to have greater stress resistance than wildtype (N2), measured as lifespan following acute heat stress. However, the effect of added glucose on the stress response of daf-2 C. elegans is unknown. Our results show that the presence of glucose increases daf-2 stress resistance even further. Additionally, we found that while the wildtype worms have shorter lifespans than daf-2 worms, as expected, wildtype worms on media containing glucose had higher resistance to heat stress than those without glucose. Notably, this effect is only present if the worms are stressed on the first day of adulthood. Exposure to heat stress later in life diminishes the advantage of providing glucose during stress. This age-dependent effect of glucose appears to also be the case for daf-2 C. elegans. Continuation of this project will look more specifically at glucose effects on larval, early adult, 'middle-aged', and 'old' animals, as well as examine effects on another long-lived C. elegans mutant, the eat-2 model for dietary restriction (DR).

4B. Nutrient Availability vs Consumption Regulates Longevity via Steroid Signaling. Ashley Henderson, Kaley Meeks, Justin Dino, Brewer Owen, and Mindy Farris. *Biology, University of Central Arkansas, Conway, AR 72035.*

Dietary restriction (DR) extends lifespan and healthspan in a wide range of organisms, including mammals and Caenorhabditis elegans. C. elegans genetic models of DR use mutations in the eat-2 gene, resulting in restricted pharyngeal pumping and extension of lifespan by ~25%, without sacrificing function or activity.
It has been demonstrated that steroid signaling mediates the DR longevity response. Notably, C. elegans cannot synthesize cholesterol as higher animals can; it must come from their diet. Cholesterol is then converted to various products, including steroid hormone precursors. By functioning as intracellular communication, steroid signaling is a probable mechanism for organism-wide cellular responses and lifespan control. Thus, enzymes active along the cholesterol-to-hormone biosynthetic pathways are likely candidates for longevity regulators. While HSD-2 and HSD-3, two members of the conserved 3β-hydroxysteroid dehydrogenase (3β-HSD) family, are required in C. elegans for lifespan extension and stress resistance conferred by DR, the hormone or hormones generated by these steroidogenic enzymes have not been identified.
Double eat-2;hsd-2 and eat-2;hsd-3 mutant strains of C. elegans were generated from single mutant stocks and used to analyze the role of the HSD-2 and HSD-3 molecular products in lifespan extension. HSD-2 is required for eat-2 mediated lifespan extension and late-life stress resistance, while HSD-3 is required for eat-2 early-life stress resistance.
Another mechanism of inducing DR in C. elegans is bacterial deprivation (BD), where worms are placed on solid media in the absence of food. This technique may be accomplished using nematode growth media (NGM, containing agar, salts, peptone, and cholesterol) or minimal media (MM, lacking peptone). In contrast to the eat-2 mutation, which is necessarily life-long, BD can be applied at specific times in the worm lifespan. We are examining effects of hsd-2 and hsd-3 on BD-mediated lifespan and stress resistance in order to determine whether these hormone effects are eat-2 specific as well as consider the coordinated timing of nutrient availability and hormone signaling. We have found that while hsd-3 is required for eat-2 early-life stress resistance, it does not appear to be required for BD early-life stress resistance. Experiments with hsd-2 and late-life stress resistance are ongoing.
As HSD-3 is expressed in larvae and HSD-2 is expressed in adults, the timing of the required hormone production can potentially be determined. GC-MS analysis of extracts from C. elegans with mutations in the hsd-2 or hsd-3 genes will be combined with lifespan analysis of the eat-2;hsd-2 and eat-2;hsd-3 double mutant strains. Candidate hormones (hormones identified either from the literature as being enriched in long-lived animals or via GC-MS data) will be fed to the eat-2;hsd-2 and eat-2;hsd-3 double mutant animals. Hormones able to rescue the eat-2 longevity phenotype are putative mediators of lifespan extension via DR.

5A. Neuronal Differentiation for Transplantation Therapy: Role of Matrix Components. Shontiara Johnson, Sahitya Chetan Pandanaboina, Dustin Rhoads, Malathi Srivatsan. *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Neurodegenerative diseases and brain injuries affect millions of people worldwide when functional units of the nervous system, neurons, are unable to function and die. Since neurons do not divide, unlike other cells in the body, and cannot replace themselves once they are lost, cell transplantation therapy is being proposed as a cure for these diseases. However, transplantation therapy requires a large number of neurons and neural stem cells (NSCs) which have the potential to differentiate into neural cells such as neurons, astrocytes, and oligodendrocytes. Researchers are trying different methods such as using growth factors, small molecules and cell-released vesicles known as exosomes from different tissue sources to increase neuronal differentiation from NSCs. Mesenchymal stem cells (MSCs) are multipotent stem cells that give rise to extracellular matrix (ECM), blood vessels, cartilage, bone, and muscle. Since MSCs and NSCs develop together, we hypothesized that MSC-derived molecules and vesicles including exosomes could influence neural differentiation. To test this hypothesis, conditioned medium was collected from mesenchymal stem cell culture and exosomes were isolated from the conditioned medium using Norgen Midi Exosome isolation kit (Norgen BioTek, Canada). Rat neural stem cells were then differentiated using (1) Conditioned medium (2) Isolated exosomes (3) Conditioned medium depleted of exosomes for one week to see if beneficial components obtained from different conditions would promote neuronal differentiation. Our initial results suggested that the medium of mesenchymal stem cells consists of neuronal differentiation promoting as well as inhibitory molecules and exosomes isolated from mesenchymal stem cells help promote differentiation of more neurons.

5B. Effects of Low Tunnel Plastic Type on Early Development of Day-Neutral Strawberries. Paige Akins, Mary Rogers. *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Strawberry consumption in the U.S. is steadily increasing, and demand is strong for locally produced and organic fruit. Protected culture systems, including

low tunnels, modify the microclimate and allow for season extension and higher quality fruit. In this project, we investigated the effects of UV blocking and UV transmitting plastic on early growth of day-neutral strawberries in low tunnels. This research project is being conducted within the context of a longer-term project looking at how low tunnel coverings affect strawberry fruit yield, quality and insect pest management. In this project, we assessed vegetative and reproductive growth and leaf chlorophyll content of day neutral 'Albion' strawberry plants during eight weeks of production under the three different treatments: UV transmitting, UV blocking, and open plots. The transmitting and blocking plastic treatments saw significantly higher numbers of flowers and leaves compared to the open control plots. Vegetative growth was not distinctly correlated with leaf chlorophyll content in any treatments. These research efforts contribute to our understanding of strawberry production in Minnesota to help meet the growing demands for local, organic strawberries.

6A. A Biological Inventory of Lafferty Spring Cave (Izard County, AR). Makala White, David Thomas, Ethan Ballard, Cassia Oliveira. *Science Division, Lyon College, Batesville, AR 72503.*

During the period of July 2013 through June 2017, we completed seventeen trips through Lafferty Spring Cave in Izard County, AR. During these trips, we counted animals and collected water and soil samples. Heterotrophic and autotrophic microorganisms were cultured from the samples, and identified by ribosomal gene sequence analysis (in progress). Animals were photographed and identified using assorted field guides. No animals were taken from the cave.
As its name implies, a creek flows throughout the length of the cave, and emerges as Lafferty Spring below the cave's entrance. Although the water output from the spring varied over the year, the cave creek and spring appear to be perennial. Several pipes carry the spring water to nearby properties, where presumably it is used for irrigation. The cave is approximately 200 meters long. At the back of the cave, the creek creates an impassable sump. Lafferty Spring Cave is a fairly typical limestone cave with both erosional and depositional formations. The cave creek has a gravel bed that is covered with clay and silt in places. Characterization of the soil and its microbial biomass is in progress.
Animal inventories are still in progress. However, we noted that this cave has the highest population density of salamanders of any of the caves we have studied to date. In June 2014, we counted 145 salamanders in a single trip. Conversely, bats are relatively scarce. The highest population counted was 45 tricolored bats (Perimyotis subflavus) in January 2016; two bats had visible signs of white nose syndrome. We were not able to get a bat count during winter 2016-17. Notable vertebrate animal species within the cave included cave salamanders (Eurycea lucifuga), dark-sided salamanders (Eurycea longicauda melanopleura), long-tailed salamanders (Eurycea longicauda), grotto salamanders (Eurycea spelea), western slimy salamanders (Plethodon albagula), pickerel frogs (Rana palustris), and tri-colored bats (Perimyotis subflavus). Invertebrate animals include: camel crickets (Ceuthophilus sp.), spiders (order Araneae), mosquitoes (family Culicidae), heleomyzid flies (family Heleomyzidae), amphipods (Stygobromus sp.), daddy longlegs (family Sclerosomatidae), centipedes (class Chilopoda) and bladetooth snails (Patera sp.).
Unlike most caves in the region, we found very little graffiti and other vandalism in this cave. We found very little trash in the cave. Members COBRA Grotto of the National Speleological Society assisted during cave expeditions. This research is funded by the Arkansas Space Grant Consortium.

6B. 16S rRNA Gene-Based Metagenomic Analysis of Ozark Cave Bacteria. Ethan Ballard, Cassia Oliveira, Lauren Gunderman, Cathryn A. Coles, Jason Lochmann, Megan Parks, Galina Glazko, Yasir Rahmatallah, Alan J. Tackett, David J. Thomas. *Science Division, Lyon College, Batesville, AR 72503.*

The microbial diversity within cave ecosystems is largely unknown. Ozark caves maintain a year-round stable temperature (12-14°C), but most parts of the caves experience complete darkness. The lack of sunlight and geological isolation from surface-energy inputs generate nutrient-poor conditions that may limit species diversity in such environments. Although microorganisms play a crucial role in sustaining life on Earth and impacting human health, little is known about their diversity, ecology, and evolution in community structures. We used five Ozark region caves as test sites for exploring bacterial diversity and monitoring long-term biodiversity. Illumina MiSeq sequencing of five cave soil samples and a control sample revealed a total of 49 bacterial phyla, with seven major phyla: Proteobacteria, Acidobacteria, Actinobacteria, Firmicutes, Chloroflexi, Bacteroidetes, and Nitrospirae. Variation in bacterial composition was observed among the five caves studied. Sandtown Cave had the lowest richness and most divergent community composition. 16S rRNA gene-based metagenomic analysis of cave-dwelling microbial communities in the Ozark caves revealed that species abundance and diversity are vast and included ecologically, agriculturally, and economically relevant taxa. Members COBRA Grotto of the National Speleological Society assisted during cave expeditions. This research is funded by the Arkansas Space Grant Consortium.

7A. Cellular scaling in brain of the nine-banded armadillo (Dasypus novemcinctus). Nicole Poling, Amanda Sieczkowski, Emily Fagan, Jeffrey Padberg. *Biology, University of Central Arkansas, Conway, AR 72035.*

The distribution of neurons and non-neurons in mammalian brain structures varies significantly across species. The cellular distributions of mammalian brains have been widely studied, but quantitative examination of cellular composition of xenarthran species has not yet been described. In this study, we used the isotropic fractionation technique to determine the number of neuronal and non-neuronal cells in the neocortex, pyriform cortex, and hippocampus of the nine-banded armadillo, Dasypus novemcinctus, the only xenarthran species in North America. The right and left sides of each structure were processed separately. Cellular nuclei were identified by staining with 4',6'-diamidino-2-phenylindole (DAPI), and all neuronal nuclei were identified by immunocytochemistry for the neuronal nuclear antigen (NeuN). Neuronal nuclei were also secondarily stained with AlexaFluor 555 or 594 for visualization. Here we present the first quantification for neuronal and non-neuronal cell counts for the armadillo brain. The armadillos used in this study had body masses ranging from 5.0-6.1 kg and brain masses ranging from 10.7-13.9 g. We observed that the armadillo brain ranges from 36-44.1 million non-neuronal and 4 million neuronal cells in the cortex, 49-55.7 million non-neuronal and 4.8-5.6 million neuronal cells in the pyriform cortex, and 15.5-33.5 million non-neuronal and 3-5 million neuronal cells in the hippocampus. Based on these results, the cortex is 9-10% neurons, the pyriform cortex is 8-10% neurons, and the hippocampus is 14-18% neurons. The neuron densities in these structures ranged from 1.2-1.9 million neurons per gram in the cortex, 1.8-1.9 million neurons per gram in the pyriform cortex, and 4.8-6 million neurons per gram in the hippocampus. With the data from this study, we can add xenarthrans to the large number of species whose brain cellular compositions have been previously studied. Studying the cellular distribution of the armadillo brain not only provides insight into the brain structure and function of a xenarthran species, but also enhances our understanding of cellular scaling rules across different mammalian clades and the evolution of brain structures in general.

7B. Organization of the retinofugal pathway in the nine-banded armadillo (Dasypus novemcinctus). Brooke Skinner, Alxandr Kane York, Jeffrey Padberg. *Biology, University of Central Arkansas, Conway, AR 72035.*

Previous research has shown that animals with forward facing eyes, such as predators and primates, exhibit partial crossing over of the retinofugal pathways at the optic chiasm. In contrast, animals with laterally positioned eyes, such as rodents, exhibit almost exclusively crossed pathways; the retinal pathways terminate overwhelmingly on contralateral thalamic nuclei. The aim of the current study was to determine the organization of retinofugal pathways in the nine-banded armadillo (Dasypus novemcinctus), a member of the Xenarthra superorder and the only species of armadillo found in North America. Extant xenarthrans lack cone photoreceptors, and it has been suggested that stem xenarthrans became rod monochromats, in conjunction with a fossorial lifestyle. Based on their relatively lateral eye position, we predicted that the retinofugal pathways would exhibit nearly exclusively contralateral projection. Monocular injections consisting of twenty microliters of fluorescent anterograde tracer (.5-1% WGA+CTB Alexa-Fluor 555 with 2% DMSO) were placed into the vitreous humor of the eyes of armadillos. Cytoarchitectural stains such as Nissl and cytochrome oxidase (CO) histochemistry, along with immunocytochemical techniques using antibodies to calbindin, parvalbumin, and nonphosphorylated neurofilament protein, were used to identify the thalamic nuclei. The dorsal and ventral divisions of the lateral geniculate nucleus (LGN) stained intensely for CO, with a thin intrageniculate leaflet separating the two. Tracer label was observed contralaterally in both the dorsal and ventral divisions LGN and in the most superficial layer of the superior colliculus. An area within the dorsal portion of the contralateral LGN was void of label, which is indicative of the recipient zone of projections from the ipsilateral eye, as there was a corresponding patch of label on the ipsilateral side. This overall pattern resembles the organization found in marsupials and eutherian mammals with laterally placed eyes, and thus, it is likely that armadillo vision is predominantly monocular. Future functional studies are likely to reveal the extent to which a frontal binocular field, if any, is present in this species.

8A. Detecting MC4R Neurons in the Body's Periphery. Khadijah Jones, Eugene Niyamugenda, Giulia Baldini. *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Obesity and diabetes are serious health problems that are found predominantly in the Western world, as well as in our state. The obesity epidemic is promoted by consumption of high fat diets. Through research we strive to find an answer for this problem. The hypothalamus of the brain is important for regulation of the body's energy metabolism. It modulates food intake and energy expenditure to maintain body weight. The liver is a master regulator of body's metabolism. It is innervated by afferent and efferent fibers that are part of the autonomic nervous system. This innervation is key for the liver to regulate metabolism, as well as constricting and relaxing sinusoidal vessels located in

the hepatic lobules. The connection between brain and liver allows signals to be transmitted from liver to brain (afferent pathway) and brain to liver (efferent pathway) to trigger metabolic processes. Understanding the hepatic nervous system may help find targets to treat obesity and diabetes. We know that Single-minded 1 (Sim1) neurons and melanocortin-4 receptors (MC4R) in the hypothalamus are essential for controlling food intake and energy expenditure. My project this summer is to discover if Sim1 and MC4R neurons can be found in the liver thereby giving evidence to the hypothesis that these neurons are a component of the liver/brain connection. In this project, to visualize Sim1 and MC4R neurons, we will use mice expressing EGFP in Sim1 neurons and epitope tagged HA-MC4R, respectively.

8B. Poster withdrawn.

9A. Myosin mediates protein recycling towards the Golgi. Jared Smothers, Paul Ballhorn, Kyoungtae Kim. *Biology, Missouri State University, Springfield, MO 65897.*

Myosin family proteins are ATP-dependent motors that share the same basic properties of actin binding. The chemical energy provided by ATP-hydrolysis in the head domain generates the “power stroke” necessary to “walk” along actin filaments. In this study, using confocal microscopy we assessed the potential roles of all five myosins in yeast, and their effect on the recycling of Snc1 and Vps10. Myo1 knockout strains had no significant defect in Snc1 recycling, but displayed severe defects in the trafficking of Vps10 toward the Golgi, manifested by abnormal localization to the lumen of the vacuole. Myo3 and Myo5 are paralogs that have little to no phenotypic effect on functionality when knocked out individually, but the double deletion of both Myo3&5 led to severe defects in Snc1 and Vps10 trafficking. Two temperature sensitive strains of Myo2, myo2-16 and myo2-66, demonstrated trafficking defects bot h at permissive and restricted temperature conditions. Among all five members, only Myo4 deletion did not affect protein recycling pathways. Together, our data here provide novel insights into the function of Myo family proteins in protein recycling traffics destined towards the trans-Golgi Network.

9B. The Effect of Silver and Cadmium on Gene Expression. Cullen Horstmann, Chelsea Campbell, Kyoungtae Kim. *Biology, Missouri State Universtiy, Springfield, MO 65897.*

Nanoparticles are commercially used in everyday products including zinc sunscreen and water resistant fabrics and surfaces, but in the future they may be used in the targeted treatment of cancer, printable monitoring systems, and affordable phones. Understanding the effects of nanoparticles on biological organisms is crucial for the responsible use of these technologies. We investigated the effects of silver (Ag) and cadmium (CdSe/ZnS) nanoparticles on budding yeast (Saccharomyces cerevisiae) using growth assays, FUN-1 staining for metabolic activity, RNAseq, and RTPCR. Our growth assay showed that Ag has an inhibitory effect with its concentrations above 5µg/ml, whereas CdSe/ZnS had no effect on cell growth. Interestingly, cells treated with 5µg/ml Ag showed no metabolic defects. Hundreds of the same genes in both Ag and CdSe/ZnS treated cells were differentially expressed according to our transcriptome investigation, the majority of whic h are responsible for ribosomal biogenesis and nucleotide binding. Furthermore, we validated the RNAseq results using an RTPCR assay. The resulting expression profile leads us to suspect that Ag and CdSe/ZnS nanoparticle exposure creates a stress environment in the cell.

10A. Effect of Style Age, Relative Floret Position, and Pollination Treatment on Successful Pollination in E. angustifolia. Ashley R. Barto, Stuart Wagenius. *Biology, University of Central Arkansas, Conway, AR 72035.*

Disc florets in Echinacea angustifolia flowering heads emerge daily in concentric rings from the outer edge inward, and pollen availability, not pollinator visitation, limits E. angustifolia reproduction. Still, pollinator services to Echinacea are sometimes sporadic. Additionally, successful Echinacea pollination is indicated by shriveling styles, the part of the disc floret receptive to pollen. However, little is known about how pollination success is affected by style age, floret position within a head, or pulse and steady pollination treatments. Therefore, this study examines successful pollination rates for style age, floret position within the head, and pollination treatments to identify reproductive implications of erratic pollen availability in Echinacea. Over 19 days in July 2017, I pollinated 1980 styles from 21 flowering heads following a randomly assigned pollination schedule: pulse or steady. On heads assigned the pulse pollination treatment, all styles received pollen on one day, so there was a range of style ages. On the steady pollination heads, styles received pollen daily, so all styles were fresh when they received pollen. Style shriveling, a proxy for pollination, was used as the response variable. Surprisingly, style age and pollination treatment did not influence style shriveling, as determined by a generalized linear model test of main effects and interactions ($p > 0.05$). Instead, floret position within the flowering head was the only factor essential to modelling pollination rates in Echinacea angustifolia ($p < 0.01$). The results suggest resource allocation plays a major role as E. angustifolia accepts pollen. Further investigation of seed set data from the same flowering heads available later in the year will further elucidate the role of style age, floret position, and pollination treatments in E. angustifolia reproduction.

10B. Identifying Environmental Health Risks in Kanembwe, Rwanda. Mason Rostollan, Leah Horton. *Biology, University of Central Arkansas, Conway, AR 72035.*

The burning of biofuels for cooking and heating is particularly common in regions with low socioeconomic status and can lead to detrimental respiratory illness or mortality. This problem is worsened by lack of affordable healthcare and poor environmental health conditions. However, the use of rocket stoves may be able to lower the negative health impacts by reducing smoke production. In Kanembwe, Rwanda in 2015 ten families were introduced to rocket stoves. The stoves' users report a reduction of smoke production as well as a reduction in nasal and eye irritation. In a pilot study, we used a peak flow meter and a spirometer to measure lung function in some of the residents of Kanembwe. For the preliminary data, two groups were used: those who already utilize a rocket stove and those who still cook on the traditional three-stone fire. Data were taken on the height, age and gender, then we measured the peak expiratory flow rate (PEFR) and the Tiffeneau-Pinelli index (forced expiratory volume in one second/ forced vital capacity). There was no significant difference detected between individuals cooking over rocket stoves versus those who cook over the traditional fires for either test of lung function. There was, however, a significant difference in FEPR value based on gender. Future work includes increasing the sample size of this study, identifying suspended particles in the smoke while cooking, and analyzing health risks in the drinking water.

11A. Natural variation in acquired stress resistance during oxidative stress in Saccharomyces cerevisiae. Emily Taylor Stone, Amanda Scholes, Jeffrey Lewis. *Biology, Hendrix College, Conway, AR 72032; Cell and Molecular Biology, UA Fayetteville, Fayetteville, AR 72701.*

There exists a large amount of phenotypic variation across individuals despite a relatively small amount of genetic variation across the population. The mechanisms behind this variation are not well-understood; however, researchers are coming to understand that gene-environment interactions may play a large role. Gene-environment interactions can also affect an individual's response to secondary stimuli. The study of gene-environment interaction could therefore enhance our understanding of how environmental stimuli induce phenotypic change.
We are studying an acquired stress response in the model organism Saccharomyces cerevisiae (S. cerevisiae) in order to determine what sort of natural variation exists in this phenomenon. Prior research exploited the natural variation in stress response genes among strains of S. cerevisiae, including laboratory and wild strains, to study natural variation in responses to peroxide and salt stressors. While some wild oak strains (YPS163) fully acquire resistance to hydrogen peroxide, other wild strains (YJM1129, YJM627) acquire only partial resistance. This research investigated the resistance of these strains, hypothesized to lack a functional HAP1 gene. Prior studies implicated HAP1, which encodes a transcription factor for the CTT1 gene and resultant catalase enzyme, as necessary but insufficient for full acquisition. To study this phenomenon, we mated each of the respective wild strains with a hap1Δ lab strain to generate a hap1Δ hemizygote.
We found that while the wild strain YJM627 alone shows little acquired resistance, its survivorship is improved when mated with the hap1Δ laboratory strain. Conversely, the wild strain YJM1129 alone shows some acquired resistance to hydrogen peroxide. Mating with the same lab strain, however, does not significantly improve the ability of the offspring to acquire resistance. The responses of the different strains suggests that the pathway protecting against oxidative stress is not dependent upon Hap1p alone, but that, particularly for YJM1129, it can play a large role in acquired stress resistance. Future experiments will examine a YPS163 strain lacking a functional HAP1; this wild strain will be used to conduct a reciprocal hemizygosity analysis to demonstrate the role of CTT1 and HAP1 in acquired stress resistance.

12A. Evaluation of the Role of MT1H and USP-24 in Ewing's Sarcoma. Cyntanna Hawkins, Rob Griffin, Lori Hensley, Nathan Reyna. *Biology, Ouachita Baptist University, Arkadelphia, AR 72998.*

Ewing's sarcoma (EWS) is a pediatric cancer with low five-year survival rates. Previous research in our lab has shown that cannabidiol (CBD) induces apoptosis in Ewing's sarcoma cells; however, the cellular pathway used by CBD and other cannabinoids is largely unknown. Mass spectrometry was run on untreated and CBD-treated Ewing's cell lysates and 8,000 proteins were identified. These proteins were then analyzed for differential regulation between untreated and treated samples. In an effort to choose clinically relevant molecules for further investigation, we created a novel algorithm that compared clinical data from Oncomine to our mass spec results. This algorithm identified proteins that are upregulated in human Ewing's tumor samples as compared to all other sarcomas in the database, and matches it with proteins identified in the mass spec data that are down-regulated by CBD, or the converse. Of interest is ubiquitin-specific peptidase 24 (USP-24), a protein involved in cellular apoptosis. Our data show that it is over-expressed clinically and is lowered in vitro with the CBD. We are confirming this differential regulation by western blotting. Additionally, multiple members of the metallothionein family, cytosine rich proteins that are overexpressed in many cancers, were

found to be expressed at low levels clinically, but CBD upregulates their expression. This is important because these proteins have been recently shown to act as tumor suppressors in liver and colon cancer cells. This research specifically focuses on MT1H. In order to establish a tumor suppressor role in Ewing's cells, MT1H was knocked-in, and the proliferation and metastatic potential were assessed to evaluate its effect. Because metallothioneins can be transcriptionally regulated by glucocorticoids, we also examined the glucocorticoid receptor as a possible receptor for CBD in Ewing's cells. Clarifying the cellular pathways used by CBD may lead to targeted therapy for Ewing's patients.

12B. Extraction of Novel Antibiotics. Shelby Burchfield, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

The growing number of antibiotic resistant bacteria are surpassing the production of new antibiotics. Many antibiotics are synthetic derivatives of natural products; thus, environmental bacteria may be a good source for promising new antibiotics. Bacteria make antibiotics when they are crowded or starved. In order to develop these antibiotics for human use, the active compounds must be extracted, separated, and identified. In this project, we are optimizing extraction and separation of antimicrobial compounds produced by the soil bacterium Pseudomonas donghuensis. The bacterium was grown to confluence on tryptic soy agar, then the bacterial growth and agar was frozen. The thawed cells and agar were extracted using a 79/20/1 acetonitrile/water/acetic acid mixture. The extraction was air-dried and resuspended in water. The biological activity of the resuspension was tested against Bacillus subtilis and Escherichia coli using the swab-spot assay. Individual components of the resuspension were separated using reverse-phase HPLC with acetonitrile as the mobile phase; the biological activity of these components was also tested using the swab-spot assay. This work is an important step in the identification and eventual production of new antibiotics.

13A. Sarco/endoplasmic Reticulum Calcium ATPase in Neurodegenerative Disease: Implications from In Vitro Models. Jackson Hedrick, Steven Barger. *Department of Biomedical Engineering, UA Fayetteville, Fayetteville, AR 72701; Donald W. Reynolds Institute on Aging, UAMS, Little Rock, AR 72205.*

Neurodegenerative diseases are characterized by the progressive deterioration of neurons, and currently, there are no cures available. Although the precise molecular sequelae for the advancement of neurodegeneration are not known, it has been shown that intracellular calcium regulation is irregular and mitochondria are dysfunctional. The major intracellular calcium store is the endoplasmic reticulum (ER). The sarco/endoplasmic reticulum calcium ATPase (SERCA) pumps calcium from the cytosol into the ER. Proper functioning of SERCA is essential in keeping calcium levels within the ER at the needed high concentration. Recent findings have shown that a Western diet, a diet high in sugar and fat intake, is associated with a greater risk of developing neurodegenerative disease. We hypothesize that certain nutrients of a Western diet may modulate SERCA expression. To test this effect, treatments of glucose and palmitic acidâ€"a simple sugar and a saturated fatty acid respectivelyâ€"were applied to neural cell cultures. Evaluation of SERCA expression in each treatment was conducted through immunoblot analysis. Modulation of SERCA expression can cause intracellular calcium dysregulation and may have a direct effect on mitochondrial calcium levels. To examine this effect, thapsigargin, an inhibitor of SERCA activity, and Western diet nutrients were applied to primary rat neurons. Calcium levels were determined through the use of FURA-2 AM. During imaging, FCCP, a mitochondrial uncoupler, was applied to reveal mitochondrial calcium levels.

13B. C/EBPδ-deficiency promotes etoposide-induced cytotoxicity due to increased mitochondrial damage and dysfunction. Jessica Orton, Robin Raley, *Biomedical Engineering, UA Fayetteville, Fayetteville, AR 72701, Sudip Banerjee, Charis Eldred, Kimberly J. Krager, Nukhet Aykin-Burns, Martin Hauer-Jensen, Snehalata A. Pawar, Division of Radiation Helath in Dept. of Pharmaceutical Sciences, UAMS, Little Rock, AR 72205.*

Etoposide is a cytotoxic drug that is widely used in the treatment of cancers. It is a topoisomerase II inhibitor that causes DNA damage, increased production of reactive oxygen species (ROS) and increased mitochondrial damage and dysfunction. However, there is a lack of knowledge about the key target proteins which mediate the cytotoxic effects of etoposide. The transcription factor CCAAT/enhancer-binding protein delta (C/EBPδ) is implicated in the regulation of target genes involved in oxidative stress, DNA damage response, genomic stability and inflammation. However, the role of C/EBPδ in etoposide-mediated cytotoxicity has not been investigated. Based on the known roles of C/EBPδ in modulating oxidative stress and DNA damage, we hypothesize that C/EBPδ-knockout (KO) mouse embryonic fibroblast (MEF) cells will show increased sensitivity and cell death in response to etoposide treatment compared to wild type (WT) cells.
Our preliminary results indicate that KO MEFs show significant decrease in cellular proliferation after exposure to etoposide. KO MEFs showed increased mitochondrial superoxide levels and increased levels of γ-H2AX, a marker of DNA damage post-Etoposide treatment. KO cells also displayed increased mitochondrial mass post treatment indicative of etoposide induced mitochondrial biogenesis.

Ongoing studies are directed towards comparing changes in mitochondrial bioenergetics using a seahorse XF-flux analyzer and in mitochondrial morphology using electron microscopy.

14A. Proliferative Effects of Graphene Polyurethane Scaffolds for Osteogenic Differentiation of haMSCs. Nicholas Maynard, Celeste Gibson, Austin Bow, Steven Newby, Fumiya Watanabe, Alexandru S. Biris, Tom Masi, Madhu Dhar, Shawn E. Bourdo. *Biophysics, Hendrix College, Conway, AR 72032.*

Synthetic bone scaffolds are receiving great attention in regenerative medicine because they offer an alternative to bone grafting (e.g. allograft or autograft) procedures. Conventional fabrication methods combine scaffold materials with stem cells and rely on the use of growth factors to promote osteogenic differentiation. Graphene has recently been shown to accelerate osteogenic differentiation in human adipose derived mesenchymal stem cells (haMSCs) as effectively as, and with greater resource-efficiency than, the growth factor, BMP-2, suggesting its potential for use in tissue engineering. In this project, we utilized a few-layer-graphene having an oxygen content of approximately 9.8% (carbon content of 89.6% and trace amounts of sulfur and nitrogen), which we refer to as low-oxidized graphene (LOG). LOG was combined with a biocompatible polyurethane (PU) to generate a three-dimensional porous scaffold. Various ratios of LOG:PU were evaluated to determine effects of LOG upon haMSC proliferation. Here we show that proliferation was improved for porous scaffolds comprised of 1% LOG compared to other ratios and to PU alone.

14B. Using Pulldown Assays to Characterize Meiotic Proteins in Bdelloid Rotifers. Kaersti L. McLellan, Andrew M. Schurko, *Biology, Hendrix College, Conway, AR 72032.*

Bdelloid rotifers are an all-female class of aquatic microinvertebrates that reproduce asexually. Although bdelloids lack meiosis, their genomes contain four genes (MSH4, MSH5, HOP1, SPO11) that encode proteins that function specifically during meiotic recombination in eukaryotes. Intriguingly, these animals also have the ability to repair thousands of DNA double-strand breaks that result from desiccation or exposure to ionizing radiation. Therefore, it is possible that these "meiotic" proteins are maintained because they have evolved a new function in DNA repair. To test this hypothesis, our objective is to investigate the function of "meiotic" proteins in the bdelloid Adineta vaga by using these proteins as bait in pulldown assays. First, to generate bait, 6×histidine-tagged copies of each meiotic protein were constructed by cloning their coding sequences into an expression vector. Recombinant proteins were then expressed in E. coli by induction with IPTG and purified using B-PER Reagent and DynaBeads. Next, for a pulldown control, 6×histidine-tagged beta-tubulin was generated as bait, with the expectation that an interaction with alpha-tubulin from A. vaga would indicate optimized conditions. Lastly, 6×histidine-tagged meiotic proteins were used as bait and A. vaga proteins as prey. SDS-PAGE, western blots and mass spectrometry are then being used to identify potential binding partners to each meiotic protein. In subsequent assays, proteins from irradiated bdelloids will be used to characterize protein-protein interactions during DNA repair. Overall, these pulldown assays will help us determine the role of meiotic proteins in bdelloids, and rationalize the maintenance of these genes in an ameiotic lineage.

15A. Antibiotic-Producing Bacteria from Texas Soils. Dillon Luterek, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Pathogenic bacteria are becoming resistant to the antibiotics we are using right now, causing sickness to last longer or become more severe. The goal of this project is to find new antibiotics made by bacteria in our environment. Bacteria produce antibiotics to fight off other microbes and defend their space and food, almost simulating a little war. To look for antibiotic-producing bacteria, soil samples were plated and each bacterium that looked different was isolated on tryptic soy agar. After these isolated soil bacteria were grown, their antibiotic-producing ability was determined by observing growth inhibition of Bacillus subtilis or Escherichia coli on carbohydrate-limited or protein-limited M9 salts agar. Bacteria often produce antibiotics when there is an absence of nutrients they need; this antibiotic production may be triggered by carbohydrate or protein starvation. A broth of B. subtilis or E. coli was swabbed onto agar containing either 0.1% glucose and 1% peptone (carbohydrate limitation) or 1% glucose and 0% peptone (protein limitation). We then patched the isolated soil bacteria on top of the background bacterium, incubated the plate, and measured the resulting zone of inhibition. An antibiotic-producing soil bacterium will inhibit the growth of the background bacterium, producing a clear ring or zone of inhibition around the soil bacterium. We isolated thirteen antibiotic-producing bacteria, one that produced antibiotics in response to carbohydrate limitation, seven in response to protein limitation, and five in response to both protein and carbohydrate limitation. Six of the antibiotic-producing bacteria inhibited B. subtilis, five inhibited E. coli, and two that inhibited both. In future, we will continue to look for additional antibiotic-producing bacteria and will begin to characterize the thirteen isolated in this project.

15B. Effectiveness and Mechanism of Action of Modified Porphyrins for Photodynamic Therapy of Triple Negative Breast Cancer Cells. Hannah Brandon, Alex Abbott, Alena Savenka, Alexei Basnakian, Joe Bradshaw, Tim Hayes. *Chemistry, Ouachita Baptist University, Arkadelphia, AR 71998.*

Triple negative breast cancer (TNBC) is a particularly aggressive form of breast cancer that lacks the three molecules typically targeted for treatment. It shares many characteristics with basal-type and BCRA1-related tumors; however, not all TNBCs show these characteristics. Standard treatment methods leave much to be desired- the rates of metastasis and recurrence are high and the prognosis for most patients with TNBC is poor.
One potential treatment for TNBC is photodynamic therapy, which uses compounds called photosensitizers that are taken up by all tissues in the body. The tumor is exposed to light, activating the photosensitizer and creating reactive oxygen species that cause cell death. This method is relatively pain-free, effective, and does not harm cells that aren't exposed to light.
The goal of our experiments is to assess the effectiveness as PDT agents of porphyrin derivatives in vitro on MDA-MB231 triple-negative breast cancer cells. An MTT assay was performed to quantify cell death. Cells that were exposed to light showed concentration-dependent cell death and the LD50 of each porphyrin was measured. Cells not exposed to light only showed dark toxicity at high porphyrin concentrations.
For one of the porphyrins, experiments were performed to determine the mechanism of cell death. A TUNEL assay was performed to measure DNA fragmentation, and the TUNEL-stained cells were co-stained with antibodies to help identify the method of cell death. These experiments should identify whether the cells are dying through apoptosis, necrosis, or another mechanism. Understanding the relative phototoxicity and mechanism of cell death for these compounds in these tumor cells will guide the design of compounds with improved properties as PDT agents.

16A. Evolutionary Conservation of Axon Guidance in Flies and Mice. Alli Loy, Tim Evans. *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

As the nervous system develops in animal embryos, neuronal axons are guided to their synaptic targets by extra cellular cues that signal through axon guidance receptors expressed on the surface of the axon. In animals with bilateral symmetry, one of the important decisions made by nearly every axon in the embryonic nervous system is whether to stay on its own side of the body, or to cross the midline and connect to cells on the opposite side. The Roundabout (Robo) family is an evolutionarily conserved group of axon guidance receptors that regulate midline crossing in a wide range of animal groups, by signaling midline repulsion in response to their ligand Slit. Despite their strong evolutionary conservation, it is unknown if the mechanisms of Robo signaling are conserved across different species.
Can Robo receptors from mice regulate axon guidance decisions in Drosophila embryos, or do species-specific difference exist in the cellular signaling mechanisms by which Slit and Robos regulate midline crossing? To investigate the evolutionary conservation of Robo signaling mechanisms, we are using the GAL4/UAS system in Drosophila to express Robo receptors from mice in fly neurons during embryonic development. We find that mammalian Robo receptors can repel axons from the midline in Drosophila embryos, which suggests that the mechanisms by which they signal midline repulsion are conserved in insects and mammals. However, a further study involving a GAL4/UAS rescue of mutated Drosophila Robo receptors with mouse Robo receptors indicates that mammalian Robo genes cannot successfully effect midline repulsion in fly embryos on their own. Therefore it is still uncertain how clearly the mechanisms of Robo signaling are conserved from insects to mammals.
In addition, we are creating chimeric receptor genomes combining one Drosophila Robo domain with all other domains of mouse Robo. The effectiveness of the chimeric receptor will be tested in another GAL4/UAS rescue of mutated Drosophila Robo receptors and will again demonstrate whether or not the mechanisms of Robo signaling are evolutionarily conserved.

16B. Characterization of Angiopoietin-like 4 (ANGPTL4)-dependent TNBC Cell Extravasation Using an In-vitro Model of the Human Blood Brain Barrier. Jodi Simeon, Brooke McGinness, Haley Feezell, Tameka A. Baily. *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

Brain metastasis is a frequent occurrence in triple negative breast cancer (TNBC) patients. The majority of patients die within 6 months of diagnosis despite systemic therapy and central nervous system (CNS)-targeted therapy. Consequently, there is an urgent need to elucidate the pathways that TNBC cells use to extravasate the blood brain barrier and invade the brain parenchyma. Previous studies have identified that the angiopoietin-like 4 (ANGPTL4) gene is upregulated by TNBC cells with high brain metastatic activity, although the potential role of ANGPTL4 in brain metastasis has not been confirmed or elucidated to date. Our laboratory is focused on the role of ANGPTL4 in TNBC brain metastases. In this study we suppressed ANGPTL4 expression in the TNBC cell line MDA-MB-231 using lentiviral mediated shRNA targeting the ANGPTL4 gene. Green fluorescent protein (GFP)-tagged ANGPTL4 was overexpressed in MDA-MB-231 cells using lentiviral mediated transduction. The genetically engineered cells

were used in an in vitro blood brain barrier transmigration assay to assess whether TNBC cells use ANGPTL4 to breach the tight junctions of human brain microvascular endothelial cells and to extravasate the blood brain barrier. Our contribution here is expected to (1) define a role for ANGPTL4 in the transmigration of TNBC through the blood brain barrier and (2) provide a detailed understanding of how ANGPTL4 contributes to the extravasation of TNBC cells across the blood brain barrier and subsequent colonization of the brain. These contributions are significant because once we know how TNBC cells use ANGPTL4 to permeate the blood brain barrier and to invade the brain parenchyma, we can evaluate compounds that target the pathway as possible prophylactics against TNBC brain metastasis. The innovation here is the concept that inhibition of the disruption of microvascular endothelial cell junctions caused by ANGPTL4 can be a therapeutic approach to treat TNBC patients.

17A. Collagen Increases Proliferation and Drug Resistance of Papillary Thyroid Cancer Cells Harboring BRAFV600E Mutations. Anna Sharabura, Jonathan Jenkins, Laura J. MacDonald. *Biology, Hendrix College, Conway, AR 72032.*

Thyroid cancer is the most common endocrine cancer, and incidence is increasing worldwide. Thyroid cancer can be classified as either well-differentiated or poorly differentiated. Of well-differentiated thyroid cancers, papillary thyroid cancer is most common, and is associated with activating BRAF mutations. While our understanding of the genetic basis for thyroid cancer is fairly extensive, less is known about how the tumor microenvironment alters tumorigenic characteristics of thyroid tumor cells. Recently, Jolly et al. reported that papillary thyroid tumors derived from cells harboring activating BRAFV600E mutations and PTEN deletions are enriched with fibrillar collagen which is associated with decreased survival. In this study, we investigated whether growth on collagen enhanced tumorigenic characteristics of papillary thyroid cancer cell lines with BRAFV600E mutations. Three distinct cell lines derived from mouse papillary thyroid cancer tumors were grown in the presence and absence of collagen. Morphology was assessed using brightfield microscopy. Proliferation was assessed by trypan blue staining and ATP concentration, while growth inhibition assays were used to assess response to chemotherapy drug resistance. Interestingly, our results suggest that growth on collagen contributes to a more mesenchymal morphology, increased proliferation, and decreased sensitivity to chemotherapy drugs. These and other results implicate an important role for collagen in the progression of thyroid cancer.

17B. Collagen Increases Apoptosis Resistance of Papillary Thyroid Cancer Cells Harboring BRAFV600E Mutations. Jonathan Jenkins, Anna Sharabura, Laura J. MacDonald. *Biology, Hendrix College, Conway, AR 72032.*

Thyroid cancer is the most common endocrine malignancy, and projected increases in occurrence suggest it will exceed that of colon cancer by 2030. Of thyroid cancer subtypes, papillary thyroid cancer is most common and is associated with BRAFV600E mutations, which lead to constitutive activation of the MAPK signaling pathway. Previous studies in mouse models demonstrate that papillary thyroid tumors driven by BRAFV600E mutations and PTEN deletions are enriched in fibrillar collagen. Additionally, increased collagen expression in patient samples correlated with poor survival, suggesting its presence is important for papillary thyroid cancer progression. In this study, we investigated whether growth on collagen increased resistance to apoptosis and altered related signaling pathways. Three cell lines derived from murine papillary thyroid cancer tumors were grown on collagen and assessed for increased resistance to staurosporine-induced apoptosis through Western blotting and immunofluorescence microscopy. Interestingly, our results suggest that collagen increases resistance to apoptosis in an AKT-dependent manner. Additionally, we found that growth on collagen lead to decreased sensitivity to chemotherapy drugs, which may be due to increased resistance to apoptosis. Collectively, our results suggest collagen plays a key role in regulating tumor cell characteristics.

18A. Determining the Toxicity of Bacterially-Produced Antibiotics. Logan Clay, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Antibiotic resistant bacteria have been on the rise as of late, making the search for new antibiotics urgent. Many antibiotics are derived from bacteria, which produce antibiotics when starved of certain nutrients. This research was conducted in an attempt to characterize the antibiotics produced by 45 different bacteria as either harmful or harmless to eukaryotes. This characterization, along with more research, could lead to the inclusion of new antibiotics into the line of defense against deadly bacteria. Plant seeds may be used as model eukaryotes in toxicity testing. Through a series of tests, it was found that Collards (Brassica oleraceae cv. Georgia) germinated well on the M9 salts medium used in this research. Thus, collards germination percentage was used to indicate the toxicity of bacterially-produced antibiotics. Forty-five different bacteria were plated on starvation media, 1% glucose-0% peptone M9 salts and/or 0.1% glucose-1% peptone M9 salts. Which type, or types, of plates the bacterium was plated on depended on what

circumstances induced antibiotic production. Surface-sterilized collards seeds were then plated around the bacteria, and on water agar control plate. Three trials were conducted for each bacterium. After five days of incubation at 25°C, the number of seeds that had sprouted on the starvation plates were counted and compared to the number of seeds that had sprouted on the water agar control plate. This comparison determined the toxicity of the antibiotic that the bacteria had produced. If the percentage of seeds sprouted on the starvation plate was far less than the water agar control plate then the antibiotic is toxic; if not, the antibiotic is safe for eukaryotes. More research into the spectrum of bacteria types that these antibiotics impede the growth of could lead to advances in fighting antibiotic resistant bacteria.

18B. Chemical and Biological Assessment of the Ouachita River and Associated Tributaries Prior to the Construction of a $1.4B Paper Mill. Mary Beth Jones, Matt Savage, Jess Kelly. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Shandong Sun Paper Company, dba Sun Bio, LLC, recently announced the planned construction of a $1.4B paper mill plant in Clark County, AR. The company will be authorized to remove up to 16m gpd of water from the Ouachita River while returning 11m gpd of treated effluent back into the Ouachita. This study examined 21 standard physicochemical parameters and utilized EPA Rapid Bioassessment (RBA) protocol V for fish to characterize the pre-construction water quality of the Ouachita River in order to determine potential future impacts on the Ouachita River. Nine research sites ranging from Donaldson, AR to Tate's Bluff, AR were examined and inferences into the overall quality of the Ouachita River were made and compared to the Caddo River which has been identified as the region's least disturbed stream. Historic data was reviewed and compared to the current data. This study will provide baseline data for future pre-, during- and post-construction and operational phases of the planned paper mill to assist stakeholders in monitoring potential impacts of this planned development.

19A. The Role of Plasma Membrane Transporters in the Antifungal Activity of a Novel Peptide. Jacey Sites, Cody Bullock, Ines Pinto. *Biological Sciences, UA Fayettevile, Fayetteville, AR 72701.*

Candida albicans is the most common cause of fungal infections in humans, causing oral and systemic candidiasis. The treatments for these infections have shown both drug resistance by some Candida species, as well as strong toxicity with the current systemic antifungal drugs. Challenges like these have amplified the need for development of new fungal infection treatments. Multiple peptides are produced by the human body's natural immune response that have the ability to kill pathogens, known as antimicrobial peptides. One family of such peptides is the Histatin family which can have significant antimicrobial activity. Previous work on this project has identified a Histatin-derived peptide called KM29, which shows high fungicidal activity against many Candida species. Experimentation on Candida species can be quite challenging and intricate, so the use of the well-characterized Saccharomyces cerevisiae, a distantly related fungus, is ideal. To understand the mechanisms of this peptide's killing, a genetic screen using S. cerevisiae was developed to find mutations which conferred an increased resistance or sensitivity to the peptide. Mutations in thirty-seven different membrane transporter encoding genes were found that correlate with increased antifungal resistance to the KM29 peptide. These results suggest that the KM29 peptide potentially enters the cell via various types of transporters. We have initiated the validation of mutants belonging to various classes of transporters. Individual deletions of SAM3 and DUR3 (polyamine transporters), YCT1 (amino-acid transporter), QDR1 and QDR3 (multidrug resistant transporters) showed significant increase resistance to the KM29 peptide treatment. We are continuing to analyze mutants in other classes of transporters, including metal and carbohydrate transporters. This information can be applied to find homologous transporters within C. albicans contributing directly to the search for improved chemotherapies.

19B. The role of cis and trans factors in the induction of ENA1 gene during stress response. Manasa Veluvolu, Elizabeth McDaniel, Tara Stuecker, Jeffrey Lewis. *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

The ENA genes in Saccharomyces cerevisiae encode P-type ATPase pumps involved in the removal of sodium, calcium, lithium, and potassium ions from within the cell to the exterior. The ENA genes are strongly induced as a result of salt stress, and the resulting pumps made are crucial for excreting sodium ions to maintain homeostasis. An inability to respond to excess salt can lead to altered cellular pH, volume, and membrane potential, in addition to adverse effects on protein stability and cellular function. Our lab has found that expression of ENA1 varies between a wild vineyard yeast strain and a commonly used lab strain. Interestingly, ENA1 is induced by mild ethanol exposure in the vineyard strain, but not in the lab strain. Moreover, we have found that induction of ENA1 by ethanol in the vineyard strain allows cells to grow on otherwise inhibitory concentrations of salt. Since ENA1 has not previously been shown to be involved in ethanol stress response, we are interested in understanding the genetic basis responsible for the difference in ENA1

expression between the lab and vineyard strains. We hypothesize that the difference in response is either due to differences between the promoter sequence (cis) of each strain or as a result of differences in signaling or regulatory proteins (trans) between the strains (e.g. transcription factors). To test if the promoter sequence is the cause of the difference in ENA1 expression between these two strains, the promoters will be swapped in the two strains and expression will be analyzed with qPCR. If it is found that the promoter sequence is not the cause of the differences observed in the two strains, then we will perform directed mutagenesis and genetic mapping experiments to identify the responsible regulatory protein. Ultimately, this line of research will shed light on the mechanisms underlying regulatory variation, and how those impact organismal fitness under stressful conditions.

20A. Evaluating the Effectiveness of MAPK, AKT, and mTOR Inhibitors in Reducing Cellular Proliferation in Cellular Models of Papillary and Follicular Thyroid Cancer. Braxton Anderson, Brianna LeBoeuf, Margaret Young, Aime T. Franco, Laura J. MacDonald. *Biology, Hendrix College, Conway, AR 72032.*

Thyroid cancer is the most common endocrine malignancy, and incidence has been steadily increasing, suggesting occurrence will exceed that of colon cancer by 2030. Papillary and follicular thyroid cancer subtypes are most common, which are activated by BRAF and HRAS mutations, respectively. Interestingly, papillary and follicular thyroid cancers are associated with different pathologies and metastases. Currently, both papillary and follicular thyroid cancers are treated by surgical removal of the thyroid followed by radioactive iodine treatment to eliminate any remaining tumor cells. Unfortunately, for individuals with progressive thyroid cancer, these treatment options are not effective, highlighting a need for increased investigation into mechanisms of drug sensitivity. In this study, we sought to evaluate the effects of MAPK, AKT, and mTOR inhibitors on murine papillary and follicular thyroid cancer cell proliferation. To accurately assess drug efficacy, we calculated GR50 concentrations for each inhibitor in six papillary and follicular thyroid cancer cell lines. We discovered that papillary and follicular thyroid cancer cell lines responded differently to MAPK and AKT inhibitors, suggesting that treatment approaches should be tailored to subtype despite having mutations in the same signaling pathway.

20B. Transcriptome Analysis Uncovers a Message During DNA Repair in Bdelloid Rotifers. Christa C. Huber, Galina V. Glazko, Yasir Rahmatallah, Marjan Boerma, Andrew M. Schurko. *Biology, Hendrix College, Conway, AR 72032.*

Bdelloid rotifers are microscopic aquatic animals that have apparently survived for more than 40 million years without sex, males, or meiosis. Bdelloids have an efficient DNA repair system that gives them the ability to recover from levels of ionizing radiation that are lethal to other eukaryotes. DNA double strand breaks induced by high doses (>1000 Gray) of ionizing radiation are repaired without significant loss of viability to the organism. The objective of this project is to characterize genes that are differentially expressed in the bdelloid Adineta vaga following exposure to ionizing radiation in order to gain insight into mechanisms of DNA repair. Transcriptome sequencing was carried out on RNA isolated from irradiated cultures of bdelloids (280 Gray total dose followed by a 30 minute recovery) and from non-irradiated controls. From this data, 567 genes were differentially expressed with 268 of the genes being upregulated and 298 downregulated in the irradiated bdelloids. Interestingly, 131 of the 567 (23.1%) differentially expressed genes lack homologs in other eukaryotes while certain genes were not fully annotated in the rotifer genome. Real-time PCR was done on a subset of differentially expressed genes to validate the transcriptome data. Gene ontology enrichment analysis was carried out to identify biological processes that were differentially regulated in irradiated bdelloids. For poorly annotated genes, random amplification of cDNA 5' ends (5' RACE) along with real-time PCR is being done to characterize the genes further. Future work will involve carrying out transcriptome sequencing of bdelloids at two additional time points (0 and 60 minutes) post-irradiation to highlight changes in gene expression during a broader timeframe following DNA damage. Overall, this ongoing gene expression analysis has identified several candidate genes for having functions in DNA repair, which will provide further insight into the mechanism DNA repair in bdelloid rotifers.

21A. Human Phase I Enzymes in APAP Overdose Subjects with Low ALT Levels. Aaron Woodall, Laura James, Prit Gill, Sudeepa Bhattachyyra. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Backgroud: Acetaminophen (APAP) is a common over-the-counter analgesic that can cause liver injury and death when administered in high doses. Changes in gene expression following APAP overdose may be more sensitive indicators of liver injury than the current clinical indicator, alanine aminotransferase (ALT). Objective: The aim of this study was to examine gene expression of Phase I enzymes in pediatric APAP overdose patients with mild liver injury, defined by ALT levels <75 IU/L, in order to understand the mechanism of APAP toxicity. Study Design/Methods: Blood samples were collected from control patients (no APAP exposure; N=5) and pediatric APAP overdose patients with low ALT levels (N=5). Using the PAXgene system,

RNA was extracted from the blood samples. From the RNA samples, cDNA was synthesized using the Qiagen RT2 kit and quantitative polymerase chain reaction (qPCR) was performed with RT2 SYBR Green MasterMix. Samples were profiled with a PCR array containing 84 genes involved in Phase I Enzyme drug metabolism and normalized to GAPDH. Data was analyzed using the delta CT method. Dysregulated genes were validated in individual assays by qPCR and normalized to Î²-actin. Results: The low ALT pediatric APAP overdose patients had higher (median [range]) ALT levels (35 [25,48] IU/L) compared to controls (16 [7, 20] IU/L). Three genes had significant downregulation, including: GZMB (-2.86 fold, p<0.01), ALDH6A1 (-2.13 fold, p<0.01), and CYP4F12 (-4.04 fold, p<0.05). GZMB and ALDH6A1 downregulation was confirmed; CYP4F12 will be validated in future experiments. Pathway analysis for the three indicated genes pointed to signaling pathways connected to apoptosis, metabolism of valine and pyrimidine (involved in protein biosynthesis), and hydroxylation of leukotriene B4 (involved in inflammation). Conclusions: GZMB, ALDH6A1, and CYP4F12 are downregulated in patients with mild liver injury following APAP overdose. Dysregulation of Phase I Enzyme drug metabolism pathways has relevance for understanding mechanisms of cell injury in APAP toxicity. Further research that expands the PAXgene database is needed to confirm these results.

21B. Isolation and characterization of an antibiotic-producing bacterium. Cameron Brownlee, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

While humans use antibiotics to control the growth of bacteria that infect us and make us sick, some bacteria naturally produce antibiotics of their own to inhibit growth of competing bacteria. The Microbiology course-based research project at Ouachita Baptist University was to identify and characterize antibiotic-producing bacteria that naturally exist in the soil. Bacteria were isolated from the soil and characterized by the colony appearance. Isolated bacteria were then screened for antibiotic production against two different bacteria, Escherichia coli or Bacillus subtilis, on plates that induced glucose or protein starvation. The elimination of one of these critical nutrients elicited a specific response, catabolite repression for glucose starvation and stringent response for protein starvation. Isolated bacteria were patched on top of swabbed E. coli or B. subtilis. After 48h incubation at 25C, the plates were observed for zones of inhibition around bacterial patches, where antibiotic production was indicated by growth inhibition of the background bacteria to form a clear or hazy ring. We screened 24 soil bacteria, discovered 6 bacteria that produced antibiotics, and selected one, number 2, for further characterization. Number 2 produced antibiotics with limitation of glucose that effectively inhibited growth of E. coli. After metabolic characterization and BLAST, we determined our bacterium to be of the Pantoea agglomerans species complex. Since P. agglomerans has been documented to produce antifungal antibiotics, our result is interesting because it indicated a seemingly expanded efficacy range. In the Microbiology course, further research will be done to identify more antibiotic-producing bacteria as sources for natural antibiotics that have the potential to be used in the medical field.

22A. Effects of prolactin and cortisol on solute and water transport proteins in the gill of Japanese rice fish. Hannah Weber, Christian K. Tipsmark, Laura V. Ellis. *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

Euryhaline fish, such as the Japanese rice fish (Japanese medaka; Oryzias latipes), are capable of moving between seawater and fresh water. Euryhaline activity is achieved through a high degree of phenotypic plasticity in the osmoregulatory organs, in particular the gill. In fresh water, fish has a higher concentration of salt in their blood than what is found in the external environment. This leads to diffusive loss of ions and osmotic water loading. Salt loss is compensated in the gill by specialized salt pumping cells (ionocytes) that actively take up ions from the dilute environment. To combat the osmotic stress of cells in surface epithelia, like gill and skin, we hypothesize that water pores (aquaporins) may act to safeguard cell volume. The endocrine system plays an important role in the regulation of water and ion movement. Specifically, the hormones prolactin and cortisol have in fish been found to be fresh water adjusting hormones. The purpose of this study was to examine how the endocrine system regulates specific solute transport proteins and in the gill of medaka. We used in vitro experiments to determine the response to prolactin and cortisol. The data demonstrated the coordinated control by prolactin of genes that are instrumental for ionocyte salt retention (ncc2b, clcn2) and the putative volume regulatory gill aquaporin (aqp3). This is the first molecular evidence in medaka showing that freshwater acclimating prolactin plays a dual role, by both securing salt retention and safeguarding epithelial cell volume at the interface between blood and water.

22B. Understanding Natural Variation of Ethanol Stress Signaling in Saccharomyces cerevisiae. Sydney D. Pareti, Tara N. Stuecker, Jeffrey A. Lewis. *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

All organisms experience stress and have thus evolved to maintain internal homeostasis under different environmental conditions. Failure to adapt to environmental stressors can cause catastrophic damage to the organism. We use the budding yeast

Saccharomyces cerevisiae as a model eukaryote to understand cellular strategies to help survive said damage. One strategy S. cerevisiae has developed is a massive remodeling of gene expression called the Environmental Stress Response (ESR), which is activated by many diverse types of stress. The ESR includes over 1,000 genes (>15% of all yeast genes); most of the ~600 genes with reduced expression are directly involved in protein synthesis and cell growth, while the ~300 induced genes encode diverse functions linked to stress defense. Induced genes help protect cells against stress, while ESR-gene repression helps redirect translational capacity to induced mRNAs. Regulation of these expression programs is remarkably complex, and we have limited understanding of the upstream signaling network that controls expression. Moreover, we have little understanding of how individual wild yeast strains with unique genomes differ in their gene expression response to stress. Because of known links between stress-activated gene expression and disease, this line of research has important implications for personalized medicine. We have begun to investigate the signaling cascades for wild yeast strains, and noticed substantial differences in what genes are expressed when exposed to ethanol stress. To more fully understand how wild yeast strains respond to ethanol, a mutant hunt will be conducted. Our strategy to track ESR expression during the mutant hunt is to use specific ethanol- responsive reporter genes that have been tagged with Green Fluorescent Protein (GFP). We chose five reporter genes with demonstrated differences in ethanol-responsive gene expression in three different yeast strains. We will use these reporters to identify genes responsible for ethanol induction by screening for mutants with increased or decreased GFP fluorescence. Ultimately, our strategy will increase our understanding of how natural variation shapes differences in cellular signaling networks.

23A. Developing the Tools for CRISPR/Cas9 Genome Editing in Bdelloid Rotifers. Sarah E. Gilmour, Andrew M. Schurko. *Biology, Hendrix College, Conway, AR 72032.*

Bdelloid rotifers are a class of small aquatic animals that exhibits a remarkable ability to repair DNA damage following irradiation or desiccation. This makes bdelloids a valuable model for studying DNA repair mechanisms. The objective of this project is to develop the tools for employing CRISPR/Cas9 genome editing to characterize the genes and proteins involved in DNA repair in bdelloids. At least two components of the CRISPR/Cas9 system are necessary for genome editing. First, synthetic guide RNAs (sgRNAs) target specific DNA sequences. Second, Cas9 cleaves DNA at the target. Therefore, our goal was to transfect bdelloids with a plasmid that expresses Cas9 and sgRNA. First, we explored the use of puromycin as a selectable marker for transfections. In order to determine a lethal dose, cultures of the bdelloid Adineta vaga were grown in various concentrations of puromycin. Interestingly, concentrations up to 100x the lethal dose for most other organisms were needed to inhibit growth of A. vaga. Next, to construct a plasmid to be used for CRISPR/Cas9 genome editing, we used PCR to amplify different lengths of the A. vaga beta-tubulin (AvBTUB) promoter. These sequences were cloned upstream of a puromycin-resistance (PAC) gene in one plasmid. We also cloned the AvBTUB promoter sequences into a separate plasmid upstream of the gene encoding Cas9/GFP. Following transfection, individuals containing these plasmids could be identified by GFP fluorescence, puromycin resistance, and/or plasmid gene expression detected by RT-PCR. Lastly, the AvBTUB-pCas9/GFP and AvBTUB-puro cassettes will be ligated into the same plasmid. Eventually, this plasmid will also contain a cassette that expresses sgRNAs to allow for targeted genome editing. Ultimately, this will provide a valuable tool for targeting candidate DNA repair genes to learn more about their functions in bdelloids.

23B. The role of the Neurogenin1 gene in the development of nociceptive neurons in the mouse dorsal root ganglion. Shmin Alice Fan, Benjamin Curry, Dylan Gilbreath, Richard Murray. *Biology, Hendrix College, Conway, AR 72032.*

The mouse dorsal root ganglia (DRG) are paired structures that lie adjacent to each vertebrae in the spinal cord and contain a collection of neuron cell bodies that include nociceptors, the neurons that sense pain. In the ongoing attempt to understand how the nervous system develops the correct number of neurons in the correct location at the right time, the Murray lab has done preliminary research on the development of pain sensing nociceptors in the DRG. The transcription factor gene neurogenin1 (ngn1) is expressed in dorsal root ganglion progenitor cells that give rise to the sensory neurons in this tissue and a previous study found that nociceptors do not develop in knockout mice that lack the ngn1 gene (Ma et al., 1999). Based on this result, it is possible that ngn1 is required for the progenitor cells to differentiate into nociceptive neurons, but it is also possible that ngn1 is required for the developing cells to survive. To distinguish between these possibilities, the objective of this project is to determine the fate of progenitor cells in ngn1 knockout mice that cannot express the gene. To do this, we will compare the number of neurons and glial cells that form from dorsal root ganglia (DRG) progenitor cells in both wild-type and ngn1 knockout mice to see if the progenitor cells simply die or switch fate in the absence of ngn1 function. We have examined the expression patterns of known cell markers for glial cells (fabp7), neurons (NCAM), and progenitor cells (Sox 9, Sox 10) in both wild type and ngn1 knockout mice using in situ

hybridization with complementary RNA probes and immunohistochemistry with antibodies to the proteins. The results of our comparative analysis will be presented.

24A. Carbon Nano-Onions as an Extra-Cellular Matrix for Neurite Differentiation. Casey Roark, Rachel Bacon, Madison Crosby, Raj Kore, Rob Griffin, German Raul Perez Bakovic, Shannon L. Servoss, Nathan Reyna, *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701; Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Nanostructures have garnered attention as potential extra-cellular growth matrices for use in regenerative medicine. When neurons are damaged, they are not replaced, and the result is a loss of feeling or in some cases paralysis. One poorly understood aspect of neuron differentiation is how neurons and neural support cells interact with a complex extra-cellular matrix. Our research has specifically focused on the interaction of carbon nano-onions with peripheral neuron (PC12) differentiation and growth. Nano-onions are concentric shells of carbon atoms that are globular in shape with a high surface to volume ratio. Non-adherent PC-12 cells were grown in the presence of nano-onions with Neuro Growth Factor (NGF). Cell growth and morphology were monitored over five days and compared to cells growing on collagen. Western Blot analysis was used to determine changes in gene expression at the protein level related to cell differentiation. Results will be reported.

24B. Antibiotic Efficacy Range of Potential Biocontrol Bacteria. Taylor Johnson, Tyler White, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Some species of soil bacteria produce antibiotics in response to starvation, possibly to compete against other bacteria. The antibiotic compounds produced by these bacteria could potentially be used to manage antibiotic-resistant strains of pathogenic bacteria such as multidrug-resistant Acinetobacter, methicillin-resistant Staphylococcus aureus, and drug-resistant Mycobacterium tuberculosis. This work explores the efficacy range of the antibiotic compounds produced by 15 potential biocontrol bacteria which were isolated from soil samples by Ouachita Baptist University students. When these bacteria are grown on starvation media they inhibit the growth of Bacillus subtilis and/or Escherichia coli but do not noticeably suppress germination of collards, a model eukaryote. In this study, these bacteria will be plated onto glucose- or peptone- limited agar plates alongside the pathogen surrogates Klebsiella pneumoniae, Enterobacter aerogenes, Candida albicans, Staphylococcus aureus, or Mycobacterium smegmatis and incubated for 5 days. The nutrient-limited agar is expected to induce antibiotic production by the soil bacteria; the efficacy of antibiotic compounds will be determined by growth inhibition of the pathogen surrogates.

25A. Microsecond-Level Simulations Reveal Membrane Protein Insertion Mechanism of Insertase YidC. Thomas Harkey, Jeevapani Hettige, Mahmoud Moradi. *Biological Sciences, Department of Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

YidC, a member of the YidC/Alb3/Oxa1 insertase family, mediates membrane protein assembly and insertion both with and without the involvement of Sec machinery. The mechanistic details of the insertion process, however, remain elusive at the molecular level partly due to experimental limitations associated with structural studies. Here microsecond-level all-atom molecular dynamics (MD) simulations are employed to investigate the structural dynamics of YidC both in its apo form and bound to a Pf3 coat protein in order to characterize the Sec-independent protein insertion mechanism of YidC.
Structural studies suggest that the cooperative interaction between the cytoplasmic loops (C1 and C2), the conserved hydrophilic groove of YidC, and the incoming peptide are the framework for the binding/insertion mechanism of YidC. Our simulations provide a dynamic picture of protein structure at atomic resolution that complements the limited structural data. We have modeled YidC both without the C2 loop, which is missing in the crystal structure, and with a modeled C2 loop. Both systems were modeled in the natural environment of the protein involving lipids, water, and ions, followed by microsecond-level simulations. We have also modeled the same systems with a docked Pf3 coat protein in different poses and performed microsecond-level simulations.
The data provided by our extensive set of simulations suggest a key role not only for the C1 loop, which has already been suggested, but also for the missing C2 loop that stabilizes the protein according to our model. More importantly, the simulations illustrate the role of water dynamics in the insertion process of the Pf3 coat protein, which involves several stages of entering and exiting the waters to the core region of the protein while the substrate is being inserted in the membrane.

25B. Investigation of the role of TST homologs in stress response in mycobacteria. Joseph Anthony Chacko, Ravi Barabote. *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

Tuberculosis (Mycobacterium tuberculosis) is a worldwide, infectious disease claiming two million lives each year [5]. The ongoing battle against tuberculosis requires the production of new vaccinations and antibiotics for treatment. Genetic analysis of M.

tuberculosis is the guide to understanding the growth and virulence factors associated with the bacteria in order to find innovative avenues to treat this disease. Mycobacterium smegmatis (M. smeg) wild type strain mc2155 is the model organism for studying Mycobacterium tuberculosis as well as Mycobacterium leprae which are the pathogenic agents for tuberculosis and leprosy, respectively [2]. We use M. smeg in our research because it is non-pathogenic and fast-growing with a doubling time of approximately four hours and colony generation in two to three days [3]. We are interested in defining the expression of five homologs (cysA, sseA-1, sseA-2, sseB, and MST [2]) of the thiosulfate sulfurtransferase gene in M. smeg. Thiosulfate sulfurtransferase (TST) has been reported to catalyze the transfer of sulfane sulfur [1] and has been found to be up-regulated during intracellular growth of pathogenic mycobacteria [4]. The goal of our project is to investigate if the TST gene homologs are important for stress adaptation during mycobacterial growth and pathogenesis. With future research and experimentation, the TST genes found in mycobacteria could become a target for the development of novel drugs to combat against mycobacterial infection worldwide. Towards this, we have studied the growth of M. smeg in the presence of H_2O_2, which is known to induce oxidative stress. We found that there was a trend correlating an increase of hydrogen peroxide concentration and a decrease in bacterial growth. We have isolated total RNA from M. smeg after exposure to a standardized 10mM concentration of H_2O_2. Current efforts in this project are focused on analyzing the genetic expression of mycobacterial TST homologs during exposure to oxidative stress using real-time reverse transcriptase PCR.

[1] FEBS J. 2007 274(17): 4572-87.
[2] Genome Annouc. 2015 3(1).
[3] Curr Open Microbiol. 2010 13(1): 86-92.
[4] Proteome Sci. 2012 10(1): 14.
[5] Clinical Microbiology Reviews. 2003 16(3): 463-496.

26A. Dissecting the role for FAK in mediating CAP1 regulation of ERK to control breast cancer cell invasiveness and proliferation. Joshua Gray, Rokib Hasan, Faith Allen, Thomas Kelly, Guolei Zhou. *Biological Sciences, Arkansas State University, Jonesboro, AR 72401.*

We previously reported that depletion of the actin-regulating protein CAP1 (Cyclase-Associated Protein 1) in the metastatic MDA-MB-231 and BT-549 breast cancer cells led to activation of ERK (External signal-Regulated Kinase), and consistently, elevated cancer cell proliferation and invasiveness. However, CAP1 as a cytoskeletal protein is unlikely to directly regulate ERK; instead other signaling molecule(s) may mediate signals from CAP1 to regulate of ERK. We hypothesized that FAK (Focal Adhesion Kinase) may fulfill this role: we previously showed that CAP1 interacts with FAK; FAK has also been reported to activate ERK, and is activated by CAP1 knockdown in metastatic breast cancer cells. We first tested if knockdown of FAK or inhibition of its kinase activity rescues the elevated ERK activity in the CAP1-knockdown metastatic cancer cells. Interestingly, preliminary results show that inhibition of FAK activity indeed reduced ERK activity, supporting such a role for FAK. Finally, in an attempt to identify upstream cell signals that may control cancer cell functions through CAP1 phosphorylation, we found that serum stimulation induced CAP1 dephosphorylation in both metastatic MDA-MB-231 and BT-549 cells. Together, these results suggest that CAP1 may relay growth factor signals to control breast cancer cell invasiveness and proliferation through the FAK-ERK axis.

26B. Extracellular Environment Influences Neuronal Differentiation. Hannah Kling, Sahitya Pandanaboina, Malathi Srivatsan. *Biological Sciences, Arkansas State University, Jonesboro, AR 72401.*

Neurons do not divide to replace dead or injured neurons, thus leading to permanent functional loss in brain/spinal cord injury and neurodegenerative disorders. Research on Neural Progenitor Cells or Neural Stem Cells (NPCs or NSCs) has progressed to yield differentiated neurons with specific neurotransmitter phenotypes giving us the hope that new neurons will be available for transplantation in an effort to cure neurodegeneration. However there are still challenges to overcome such as increasing the yield of neurons differentiated from neural progenitor cells, targeted functional connections of new neurons to preexisting neurons, and arresting the potential of NSCs becoming cancerous. To increase the yield of differentiated neurons, scientists are experimenting with constituents of extracellular environment (ECE) in which NSCs differentiate since the ECE is known to significantly affect neuronal differentiation during embryonic development. We chose to investigate the effects of exosomes (vesicles) and extracellular matrix, two important components of ECE, on neuronal differentiation using rat NSCs in culture. Rat NSCs were propagated till passage two and then differentiated using Neurobasal medium with 2% B27 supplement (1) with or without exosomes present in fetal bovine serum (FBS) added to cultures; (2) with one component of extracellular matrix (Laminin) or with multiple components of extra cellular matrix such as laminin, collagen, entactin and tenacin (Matrigel) as substratum for the cultures. Our results show that with regards to neuronal differentiation, Matrigel as substratum outperformed all the other conditions, differentiating 49.84% of cells into neurons. Matrigel (49.84%)>FBS+Exosomes (32.52%)>FBS-Exosomes (30.48%)>Poly-D-Lysine+Laminin(29.67%). These results demonstrate that the extracellular matrix with multiple

protein components is far superior to a single component of extracellular matrix for differentiating NSCs into neurons.

27A. Isolation of a Novel Phage with En Mass Sequencing. Jonathan Askins, Justin McGee, Kayla Haberman, Charles Burnham, Brittany Backus, Chelsey Vermillion, Addison Bostian, Kinnon Dodson, Aitor Breton, Sam Eddington, Harrison Ballard, Noah Nalley, Sarah Vickers, Danial Games, Logan Bond, Nathan Reyna, Ruth Plymale. *Natural Sciences, Ouachita Baptist University, Arkadelphia, AR 71998.*

Ten novel mycobacteriophages infecting Mycobacterium smegmatis (MC2155) were isolated and characterized by the freshman at Ouachita Baptist University. The class as a group must choose one phage for sequencing and bioinformatic analysis. However, to date over 1,000 mycobacteriophage phage have been submitted to the phage database and finding a unique or interesting genome is challenging. A technique known as DOGEMS (Deconvolution of Genomes after En Mass Sequencing) was used to increase the chance of finding a novel phage for bioinformatic analysis. DNA from the ten Mycobacterium smegmatis phages were pooled and then submitted for en mass sequencing. While sequenced as a single pool, the unique phage can be bioinformatically separated as individuals during the sequenced contig assembly step. We recovered a single B4 (cluster) phage from our mixed sample, as well as multiple A, F1, K3, and L2 phage. Once identified in silico, the single B4 phage must also be identified in vivo before it can be submitted to the NCBI gene bank and phage database for archiving. Student groups designed unique PCR primers specific phage in the B4 subcluster. Student groups, using unique primer sets, independently confirmed the single B4 phage in the DOGEMS sample as RiverRat. RiverRat has 71-kb genome that contains 95 putative genes. DOGEMS proved to be a cost-effective way to identify novel phage from a large sample. We will discuss the bioinformatic analysis of RiverRat and the rationale used to design each group's primer set.

27B. JWH-018 and SSRIs: Drug-Drug Interactions and Implications on Toxicity. Christopher Godwin, *Biology, Ouachita Baptist University, Arkadelphia, AR 71998; William Hyatt, William E. Fantegrossi, Pharmacology and Toxicology, UAMS, Little Rock, AR 72205.*

Synthetic cannabinoids are a variety of psychoactive substances that have increased in use over the past few years. Synthetic cannabinoids, such as JWH-018, have been known to have negative health effects on users including occasional paralysis at high doses. It is unknown however, if co-administration of synthetic cannabinoids with common prescription drugs, such as selective serotonin reuptake inhibitors (SSRIs), can cause drug-drug interactions, which would increase toxicity. In a longitudinal study using CD1 mice, the effective doses of SSRIs Fluoxetine (10 mg/kg) and Citalopram (20 mg/kg) were co-administrated with ineffective doses of JWH-018 (0.1 mg/kg and 0.3 mg/kg). These mice were then introduced to a marble burying test. The amount of marbles that were buried in the co-administration test were then compared to control tests previously completed of the same drug doses and with the same animals. When animals were not injected or injected with saline the mice buried 6.375 marbles and 5.75 marbles on average. Then when injected with Fluoxetine (10 mg/kg) or Citalopram (20 mg/kg) the mice buried 4.25 marbles and 4.0 marbles on average. The co-administration of the SSRIs with ineffective JWH-018 at 0.3 mg/kg caused a greater effect on the marble burying with mice only burying 1.875 marbles buried (FLU) and 2.875 marbles buried (CIT). The other ineffective dose of JWH-018 (0.1 mg/kg) also caused an increased effect with 3.0 marbles buried (FLU) and 3.635 marbles buried (CIT). These increases in effect show that SSRIs and JWH-018 interact increasing toxicity.

28A. Functional Analysis of Drosophila Robo2 Fibronectin Repeats. Savanna Cathey, Tim Evans, *Biological Sciences, UA Fayetteville, Fayetteville, AR 72701.*

In the embryonic development of animals, axon guidance plays a crucial role in the formation of the nervous system, allowing neurons to connect to their synapses by extension of their axons. Axon guidance pathways regulate if axons cross the midline of the nerve cord and connect on the other side of the body or if they are repelled from the midline and stay on their original side of the body. The Roundabout (Robo) family of receptors and their Slit ligands form an evolutionarily conserved axon guidance pathway that regulates midline crossing in bilaterally symmetric animals, including Drosophila melanogaster. Drosophila has three Robo receptors that respond to Slit, and each Robo has a distinct set of axon guidance roles. Robo2, along with its role in Slit-dependent midline repulsion, also has a role in directing the formation of longitudinal pathways and promotes midline crossing. Robo2 has a conserved 5 + 3 structure that contains five immunoglobulin (Ig) domains, three fibronectin (Fn) repeats, a transmembrane domain and two cytoplasmic motifs. Although individual Ig domains have been implicated in various axon guidance roles of Robo2, nothing is known about the function(s) of the three Fn domains in Robo2.

To test whether the Fn domains are required for the various axon guidance roles of Robo2, we are using a CRISPR/Cas9 based approach to modify the Robo2 gene and delete the sequences encoding the three Fn domains (Fn1-3). We constructed a Robo2 donor

plasmid containing a robo2 cDNA from which the Fn domain sequences were deleted, and injected this donor along with a guide RNA (gRNA) plasmid into Drosophila embryos expressing Cas9. We are recovering modified robo2 alleles by screening the progeny of the injected flies by PCR, and we will examine Robo2-dependent axon guidance outcomes in embryos expressing the modified form of Robo2 (Robo2ΔFn1-3). By examining the functional requirement for Robo2's Fn domains, we hope to gain insight into how Robo2 controls axon guidance decisions in Drosophila and other animals.

28B. Investigating the Effect of Excessive Caffeine Exposure on Dictyostelium discoideum Development. Blake Tedford, Sandhya Baviskar. *Biology, UA Fort Smith, Fort Smith, AR 72904.*

Soil amoeba, Dictyostelium discoideum, is recognized by NIH (National Institute of Health) and biologists all over the world as a model organism to study various cellular, molecular, developmental, ecological, behavioral and evolutionary processes because its life cycle is simple, genome size is small and it is found in every corner of the world.
Dictyostelium discoideum, live in moist soil and feed on bacteria. Depletion of food (bacteria) causes thousands of starving unicellular amoebae to aggregate and form a migratory slug, which searches for a new feeding ground, and then culminates into a multicellular fruiting body consisting of a spore and stalk. The spores from the fruiting body are released and hatch into unicellular amoebae, thus starting the life cycle again.
We know that aggregation of amoebae upon starvation is due to extracellular release of chemical signal, cyclic AMP (cAMP) by the starving amoebae. The goal of this project was to determine the effects caffeine on Dictyostelium development. We hypothesized that different concentrations of caffeine would slow down or block aggregation of starving amoebae and affect Dictyostelium development.
We observed that starving amoebae in presence of different concentrations of caffeine cause delay in aggregation, formation of small aggregates and development of small fruiting bodies at lower concentrations and no fruiting bodies at higher concentrations. We conclude that caffeine affects cAMP formation by inhibiting several key developmental genes including adenylyl cyclase, and phosphor-diesterase at aggregate and slug stage of development.

29A. 16S rRNA sequencing of the wolf spider microbiome reveals potential for spread of disease to mammalian hosts. Nicole Lacina, Brandon Hogland, Amber Hug, Ryan Stork. *Molecular and Cellular Biology, Harding University, Searcy, AR 72143.*

The National Microbiome initiative has encouraged researchers to study all organisms relevant to human health. Many arthropods are known to carry microorganisms important to human health, yet not all groups have been focused on. Previous studies on arthropods indicate the presence of a bacterial microbiome contributing to disease. However, microbiome data on spiders is lacking. Spiders are the most numerous terrestrial predators on the planet and often come into contact with people occasionally causing bites that become infected yet we know very little about their microbiome. Previous biochemical and serological research indicated that wolf spiders such as Rabidosa rabida carry Staphylococcus species and other microorganisms that grew in culture yet could not be initially identified. We hypothesized that R. rabida would have a microbiome consisting of common microbes found in soil due to its natural habitat of fields and low grasses. We also hypothesized that R. rabida could potentially have microorganisms living in and on its surface that could be pathogenic to humans. Initial samples were obtained from the hemolymph, abdominal cavity/thorax, sucking stomach, and surface of Rabidosa rabida, a common wolf spider. Utilizing aseptic technique 47 different samples from 9 spiders were isolated, then pure cultures were obtained and sent to be sequenced via 16S rRNA analysis. BLAST Searches were performed using the NCBI database. Our analysis revealed that these spiders have a microbiome consisting of both nonpathogenic and pathogenic organisms including Pseudomonas aeruginosa, Stenotrophomonas maltophilia and Acinetobacter species that could be harmful to humans. With this analysis, we can begin to gain a better understanding of the potential zoonoses of spiders in transmitting bacteria to mammalian hosts.

29B. A Preliminary Investigation into the Antibacterial Properties of Venom from the Wolf Spider, Rabidosa rabida. Brandon Hogland, Amber Hug, Nicole Lacina, Ryan Stork. *Biology, Harding University, Searcy, AR 72143.*

The global increase in antibiotic resistance has prompted the World Health Organization (WHO) to encourage scientists to discover new antibacterial agents. In addition, the World Health Organization has identified 12 priority pathogens in desperate need of novel antibiotics. Historically, antibiotics have been identified in both fungi, arthropods and even other bacteria. From previous studies, spider venom proteins have shown antimicrobial activity, yet the antibacterial activity of Rabidosa rabidosa venom and digestive fluids has not been explored. In our study, we compared the antibacterial activity of spider venom and digestive fluids against a panel of 12 bacterial isolates. We collected and extracted venom and digestive fluid from 300 spiders over a two-week period. The

venom/digestive fluid mixture was stored at -20C. The fluids were filtered using a 0.2-micron filter to remove any contaminants picked up during the extraction process. Once enough fluid was collected, we made two-fold dilutions. To test our dilutions, we grew bacteria overnight to achieve log phase growth. Bacteria were spread out over LB plates. Five microliters of each of the venom/digestive fluid dilutions were then added to the plates and zones of inhibition were measured for each organism. A panel of currently used antibiotics was performed using the Kirby-Bauer plate method to show susceptibility patterns of the organisms tested. Zones of inhibition were measured and compared to standard charts. Only Klebsiella pneumoniae exhibited susceptibility against whole venom/digestive fluid and the first dilution containing one half the original venom/digestive fluid mixture and LB broth. The other organisms tested exhibited resistance to the whole venom/digestive fluid and subsequent dilutions. Proteins from venom and or digestive fluid from R. rabida may be a novel antibiotic against K. knuemoniae and other Klebsiella species. Further research is needed to identify specific proteins in the venom and digestive fluids that may have antimicrobial properties.

30A. Optimal Wavelength of Light for Arthrospira platensis Photosynthesis Brittany Beaver, Nathan Terry, James Taylor. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Arthrospira plantensis, more commonly known as spirulina, is a spiral-shaped cyanobacteria (blue-green algae) with a high rate of photosynthesis. Spirulina has been used as a health food and dietary supplement because it is considered to be full of many different vitamins and minerals as well as all of the essential amino acids. NASA has looked into the benefits of spirulina as a base for "space food" along with growing it in space for excess food for long missions. Photosynthetic rate was determined by measuring the oxygen production of the spirulina by trapping the gas in an apparatus that held 2.1 liters of algae in solution. The spirulina was placed in three different LED light conditions: red (620 nm), blue (460nm), and a combination of red and blue, all with the same light intensities. Oxygen was measured every 24 hours to determine which color of light induced more photosynthesis. Previous studies on Arthrospira plantensis have shown that red light is favorable for more oxygen production.

30B. Testing bacterial antibiotic production under carbohydrate and protein starvation. Briley Baird, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Bacteria produce antibiotics when they are under stress, including starvation stress. In this project, soil bacteria isolated by past Ouachita Baptist University microbiology classes were tested under carbohydrate and protein starvation conditions to validate antibiotic production previously reported on different media. Samples of these soil bacteria were plated on carbohydrate starvation agar (M9 salts agar with 0.1% glucose and 1% peptone) or protein starvation agar (M9 salts agar with 1% glucose and no peptone), on top of a swabbed background of Bacilus subtilis or Escherichia coli. After five days of incubation, antibiotic production was determined by measuring growth inhibition of B. subtilis or E. coli. Of the 27 bacteria tested, 10 were found to consistently produce the zones of inhibition, 3 under all conditions, 2 only under carbohydrate starvation conditions, and none only under protein starvation.

31A. Avian Frugivory In Fruiting Mulberry Trees (Morus spp.) In Western Arkansas. Lindsey Rice, Ashley Cooper, Jack Jackson, Ragupathy Kannan. *Biolgoy, UA Fort Smith, Fort Smith, AR 72904.*

A fruiting Mulberry tree (Morus spp.) was observed for 67 hours in the spring of 2016 and 2017 in Fort Smith, Arkansas. Details regarding avian visitations were recorded. A total of 216 five-minute scans were performed, during which the following parameters were recorded: species visited, number of individuals of each species, time of visitations, and foraging tier. Between each scan, the foraging rate (number of fruits consumed per minute), inter- and intra- specific associations, and aggressive interactions were recorded. A preliminary analysis of the 2016 data indicated that of the >20 species of birds observed, the five most common were Cedar Waxwing, American Robin, Northern Mockingbird, House Finch, and Rose-breasted Grosbeak.

31B. Isolating Exosomes Using Tumor-Specific Antibodies in the Serum and Ascites of Cancer Patients. Sylvia Szwedo, *Biology, UA Little Rock, Little Rock, AR 72204;* Karen Abbott, *Biochemistry, UAMS, Little Rock, AR 72205.*

Exosomes are small multifunctional vesicles that are rich in proteins and nucleic acids and occur in the budding stage of late endosomes. It has been suggested that the release of exosomes play a role in cell-cell communication in normal and pathological states such as cancer. Ovarian cancer being the leading cause of all gynecological malignancies has been the focus of our project. We plan on analyzing the exosome proteins from normal patients and ovarian cancer patients using lectins and antibodies to determine the glycans that are changing in ovarian cancer exosomes. The overall aim is to use glycoproteomics to identify the glycoproteins present on the exosomes. In order to do so, the exosomes must be tagged and isolated from the serum and ascites samples of ovarian cancer cells using the

provided antibodies. Methodology of Western blot technique and mass spectrometry are used to ensure the process. As of result, exosome extraction has shown promising outcomes to the project and will continue to be further investigated. Successful identification of the proteins found on exosomes may provide an efficient detective screening method for women with ovarian cancer.

32A. Identification of CDH18-interacting proteins in human embryonic kidney cells. Andrew Baker, Scotty McKay, Calin Marian. *Biolgoy, University of Central Arkansas, Conway, AR 72035.*

Cadherins are a large family of calcium-dependent cell adhesion proteins. Type I cadherins (such as E-cadherin) play an important role in cell-cell adhesion, and their function is well documented. The Type II cadherins lack the HAV coding region which plays a critical role in the adhesion functions, and their precise function still needs to be elucidated. Prior research has suggested that some Type II cadherins are involved in cancer development and early morphogenesis. By learning more about the roles that Type II cadherins play in living cells, we could gain a greater understanding of bodily processes and disease development. The protein that we are specifically interested in is a Type II cadherin known as cadherin 18 (CDH18). For this project, we used human embryonic kidney cells that were engineered to over-express this protein as well as a green fluorescent protein (GFP) tag. Here we attempt to uncover the interacting partners of cadherin 18 using co-immunoprecipitation experiments and mass spectrometry.

32B. Activation of self-renewal factors during replicative senescence in human cells. Emily Glassell, Ethan Clement, Calin Marian. *Biology, University of Central Arkansas, Conway, AR 72035.*

In the absence of telomerase, human cells undergo gradual telomere shortening due to the end replication problem. Critically short telomeres become eventually uncapped and provide a potent signal for the DNA-damage pathway. We seek to understand the changes that occur in cells undergoing replicative senescence; specifically, the impact of critically short telomeres on the expression of self-renewal factors. Using qRT-PCR and western blots we observed regulative changes of the transcription factors OCT4 and NANOG in human fibroblasts with critically short telomeres, suggesting that these self-renewal factors may play a key signaling role in senescent cells. Elucidating this signaling role may be the key to better understand cellular aging and potentially lead to the development of new anti-cancer treatments.

33A. Characterizing and Identifying Alcaligenes Species SORT-26. Morgan Lynch, Tyler White, Ruth Plymale. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

The growing number of antibiotic resistant infections worldwide has sparked a global interest in the development and management of new antimicrobial therapies. To that end, students at Ouachita Baptist University isolated soil bacteria that produced antibiotics under either glucose or peptone starvation conditions. One of these isolated bacteria, â€œSORT-26â€, is a Gram-negative, rod-shaped bacterium that produces antibiotics when grown on 0.1% glucose-1% peptone M9 salts agar. These antibiotic compounds inhibit the growth of both Bacillus subtilis and Escherichia coli, yet positively impact the germination of collards, a model eukaryote, suggesting that these compounds may be potential candidates for future antimicrobial therapies. SORT-26 was identified by 16S rRNA sequencing to be either Alcaligenes faecalis or Alcaligenes aquatilis. A combination of metabolic tests and phylogenetic analysis has been identified from literature that will be conducted on SORT-26 to characterize and identify the species and possible subspecies of this bacterium.

33B. Role of Exosomes in Neurite Development and Gene Expression. Madison Crosby, Rachel Bacon, Casey Roark, Raj Kore, Rob Griffin, Nathan Reyna. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Exosomes are small (30-100nm) membrane-bound vesicles released by cells. Recent work by our team and others have shown exosomes to carry genetic material and proteins, suggesting a role in the differentiation and growth of surrounding cells. To elucidate the role of exosomes in cell-to-cell communication, we designed two separate experiments. First, exosomes were isolated from glioma cells (U87) treated with tumor necrosis factor (TNF-α). Isolated exosomes were then added to rat neural progenitor cells lines (PC12) growing on collagen coated plates. In the second experiment, exosomes were isolated from differentiated PC12 cells and added back to untreated PC12 cells. Morphological changes were documented daily. In a previous experiment, RNA was collected and sequenced from glioma cells treated with the TNF-α exosomes. We analyzed the bioinformatics data and identified changes in gene expression. These genes coded for proteins including cytokines, kinases, and g-protein coupled receptors, which play a role in intercellular communication, morphological development and cell proliferation.

34A. The Effects of Radiation emitted from cell phones on the human head. Jaylen Gregory, Hussain Al-Rizzo, *Systems Engineering, UA Little Rock, Little Rock, AR 72204.*

Our study examines the effects of electromagnetic radiation absorbed by the human head during cell phone use. Mobile phones have been in use for over forty years and are one of the single most innovative inventions to reach the majority of population. However, studies in the past have shown that the emissions from cell phones have led to genetic damage, tumors, memory loss, increased blood pressure, and a weakened immune system. Other studies, such as the epidemiological research, show that there are some biological effects, but none dangerous to humans. By using a software program that simulated mobile phone radiation onto the human head, we were able to detect certain factors that otherwise would have been almost impossible to measure. The two main points of interest were SAR (specific absorption rate) and exposure values. For the experiment, we ran the simulation and recorded the values of SAR and exposure. We found that the amount of radiation absorbed had the potential to be dangerous humans after prolonged use.

34B. Design of Virtual Endolumenal Surgery Simulator (VESS): Colorectal Endoscopic Submucosal Dissection (ESD) Training Module. Berk Cetinsaya, Mark A. Gromski, Sangrock Lee, Zhaohui Xia, Connor Roset, Doga Demirel, Tansel Halic, Coskun Bayrak, Cullen Jackson, Suvranu De, Sudeep Hegde, Jonah Cohen, Mandeep Sawhney, Daniel Jones. *Computer Science, UA Little Rock, Little Rock, AR 72204.*

Introduction: ESD is an endoscopic technique for the en bloc resection of gastrointestinal lesions [1]. ESD is a widely-used technique in Asia, but not as prevalent in Europe or the US. The procedure is technically challenging and has higher adverse events (bleeding, perforation) compared to endoscopic mucosal resection. Inadequate training platforms and lack of established training curricula has restricted its wide acceptance in the US. Thus, we aim to develop the VESS for ESD procedures. The VESS platform will aim to provide a training and assessment platform by highly realistic visualization and high fidelity of simulating the colorectal ESD procedure. The goal of the ESD simulation is to deliver realistic haptic (touch) feedback to provide a more immersive virtual experience. This abstract describes the design and task analysis study performed to date.
Methods: Based on the ESD videos, we performed a detailed colorectal ESD task analysis to determine the critical procedural steps for the design of the VESS. Through the task analysis, the critical ESD steps including lesion identification, lesion marking, injection, circumferential cutting, dissection, intraprocedural complication management and post-procedure examination phases were detailed. Furthermore, endoscopic devices were described specific to each step of the task analysis.
Results: Using our task analysis, we constructed a hierarchical task tree that elaborates the order of tasks in these steps. Furthermore, we developed quantitative ESD performance metrics for each phase in the task tree. For the VESS design, we generated three dimensional (3D) virtual models for various colorectal mucosal lesions, using the Paris and Japanese tumor classifications [2]. 3D models of ESD devices were created. We developed realistic ESD instrument-lesion interactions with our custom-designed haptic device. We designed the electromechanical interface with 2-degrees of freedom to manipulate a dummy endoscope to provide the users with haptic feedback.
Discussion: We describe the initial phases of the design of the VESS for colorectal ESD. Through a task analysis, simulation software and Hardware-software interface developments will allow for the manipulation of virtual colorectal lesions using 3D endoscopic accessories with haptic feedback. Our quantitative ESD metrics will be used in future validation studies of the VESS simulator for performance score computation of trainees.
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35A. FszB's Function in Dictyostelium discoideum. Pristine Pittman, Kari Naylor, Nic West, Ericka Vogel. *Biology, University of Central Arkansas, Conway, AR 72035.*

Mitochondria play a central role in the function of normal, healthy cells. In order to carry out physiological processes, mitochondria must function properly. Mitochondrial function is dependent on mitochondrial structure, which in turn is dependent upon mitochondrial dynamics including fission, fusion, and motility. For this project, we observed Dictyostelium discoideum and quantified the dynamics and morphology of mitochondria expressing FszB-GFP. In addition, we quantified dynamics in this strain with disrupted microtubules or actin filaments. Based on our general knowledge of mitochondrial structure, we predict FszB to be directly involved in mitochondrial fission and fusion, functioning as a dynamic protein filament that drives these processes. This analysis will provide a better understanding of the role of FszB in mitochondrial dynamics.
We show that expression of FszB-GFP decreases fission and fusion. FszB-GFP mitochondria move faster in comparison to AX4 mitochondria, though there is not a change in the percent of organelles moving between these two strains. The morphology of FszB-GFP

mitochondria were assessed based on dispersion (clustered, even, and random, and size) and no difference was found. Finally, we show that FszB-GFP is present at almost all fission and fusion events that take place. This data suggests that FszB-GFP is directly involved in mitochondrial dynamics.
To gain more insight into the function of FszB-GFP we performed the same analysis in FszB-GFP expressing cells but disrupted the actin filaments. Our results indicate that there is significant decrease in the percent motile and velocity of mitochondria in Latrunculin-B treated. There is no significant difference of distance traveled among treated mitochondria or FszB complexes. Lat-B does not affect morphology or size of the FszB-GFP protein complexes or the mitochondria. Preliminarily, our results indicate a decrease in fission and fusion but no change in FszB-GFP localization. Analysis of FszB-GFP expressing cells with nocodazole, to disrupt the microtubules, indicates there is no difference in distance traveled, morphology or size of the mitochondria. In addition there is no significant difference between percent mitochondria moving when treated with nocodazole, though velocity is decreased. Our preliminary analysis of fission and fusion in the presence of nocodazole indicates these processes remain the same as untreated FszB-GFP and there is no change in FszB-GFP localization.
In conclusion, FszB-GFP is directly involved in mitochondrial dynamics. We propose that it may communicate between the organelle and the cytoskeleton, and overexpression of FszB-GFP may have a dominant negative effect. We have demonstrated that loss of microtubules decreases fission and fusion similar to our results here where overexpression of FszB-GFP decreases these processes but does not show an additive effect when treated with nocodazole. Interestingly overexpression of FszB-GFP and treatment with Lat-B decreases fission and fusion whereas in wild-type cells Lat-B has no effect on fission and fusion. This work furthers the idea that microtubules and actin are central to mitochondrial dynamics. Understanding the involvement of the cytoskeleton in mitochondrial dynamics will improve our understanding of countless diseases that are attributed to mitochondrial dynamic defects.

35B. Isolation of blood cells from freshwater turtles. Emily Chambers, Elias Smith, Calin Marian. *Biology, University of Central Arkansas, Conway, AR 72035.*

Read-eared sliders (Trachemys scripta) are a common species of turtles that make an excellent model organism. Blood cells provide a reliable source of genetic material, without sacrificing the animal. However, most reptilian red blood cells (RBCs) are nucleated as opposed to mammalian RBCs, causing them to sediment at differing rates. The successful isolation of pure cell fractions from reptile blood provides unique challenges. Here we attempt to separate freshwater turtle RBCs from other whole blood components. Successful isolation of freshwater turtle RBCs could lead to future environmental and physiological studies.

36A. Metallothioneins and the Glucocorticoid Receptor in Ewing's Sarcoma. Kesley Brown, Nathan Reyna, Lori Hensley, Rob Griffin. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Ewing’s sarcoma (ES) is an aggressive form of pediatric bone cancer generally presenting in the long bones, with a 5-year survival rate of < 30%. Previous research in our lab has shown that cannabinoids, ajulemic acid (AJA) and cannabidiol (CBD), significantly decrease cell viability in vitro and in vivo. In an attempt to explain the possible mechanism of these cannabinoids, a novel form of analysis was developed. Mass spec was run on untreated, CBD-treated, and AJA-treated ES cells. Data from six other sarcomas were mined from ONCOMINE, an online cancer data-mining platform aimed at facilitating discovery from genome-wide expression analyses, and differential expression of proteins specific to ES was identified. Protein levels from both sources were cross-referenced to identify proteins differentially regulated in ES clinically that were affected by cannabinoid administration. From this data, a group of cysteine-rich proteins called metallothioneins were highlighted as an area of interest. ES clinical samples showed low expression of metallothioneins compared to contrasting high-expression in other clinical sarcoma samples, while CBD upregulated expression in treated samples of ES cells. Metallothioneins are shown to be activated by heavy metals and glucocorticoids, so we hypothesized CBD could be acting upon the glucocorticoid receptor (GR), activating the metallothioneins, which in turn act as tumor suppressors in ES specifically. The GR presence was confirmed using western blot. A combination of agonists and antagonists were used to further investigate a potential role for CBD in altering activation of this pathway. Further, MTF1, a metallothionein demonstrated to have a tumor suppressor role in colon cancer was knocked in to ES cells and their resulting phenotype was assayed. Gaining insight into the intracellular pathway used by CBD will allow greater control of drug treatment and may lead to a form of targeted therapy that can be used for Ewing’s sarcoma patients.

36B. Utilization of the γ-Glutamyl Cycle by NIH-3T3 Cells. Nicholas Kowalkowski, *Biology, Ouachita Baptist University, Arkadelphia, AR 71998*. Rosaline Penney, Gunnar Boysen, *Environmental & Occupational Health, UAMS, Little Rock, AR 72205.*

Lung cancer is the leading cause of cancer related deaths in the US with an expected 228,000 new cases diagnosed per year. Lung tumors are reported to consume the amino acid glutamine (Gln) and excrete the compound glutathione (GSH), suggesting that the tumor cells actively utilize the γ-glutamyl cycle. Once GSH is excreted from the tumor cells, the γ-glutamyl group of GSH is transferred free amino acids, forming γ-glutamyl-amino-acids. The function of extracellular GSH and γ-glutamyl-amino-acids are still unclear. Glutamine, a precursor to GSH, is known to induce transformations in the NIH-3T3 cell line. Therefore, it was hypothesized the GSH or γ-glutamyl-glutamine would induce transformation in the NIH-3T3 cells. Treatment of the cells with 5mM Gln induced transformation, and thus confirmed the importance of Gln in inducing transformation in the NIH-3T3 cells. Treatment of the NIH-3T3 cells with γ-glutamyl glutamine (0.01, 0.1, 1, 2.5, or 5mM) produced a linear increase in transformations up to 2.5mM before decreasing at the highest concentration studied. These results provide evidence for γ-glutamylglutamine's ability to induce transformation in the cells. In contrast, GSH by itself does not induce transformations. Treatment with γ-glutamylglutamine plus glutamine did not show any increase in transformations compared to those induced by glutamine alone, suggesting that these compound work by the same mechanism. Together, these results indicate that if malignant lung tumor cells migrate from normal tissue, excrete GSH, and produce γ-glutamylglutamine, it may initiate transformation in the normal tissue.

37A. Investigations into the Effects of Caffeine on Cell Death in Dictyostelium discoideum. Kristen Gregory, Azure Yarbrough, John Bush. *Chemistry; Biology, UA Little Rock, Little Rock, AR 72204.*

Dictyostelium discoideum is a haploid amoeba that is found in the wild and used as a model organism in different applications. The purpose of this study was to look at cell death with and without caffeine to see where death is inhibited. Caffeine is used in commercial and medical applications in today's world and studying caffeine will help in understanding what happens and how it affects us when it goes through our bodies. In D. discoideum, it has been shown to block the binding site of cAMP. I tested three different cell lines with and without caffeine. Each experiment was completed in triplicate and statistical analysis was completed. One cell line was ddRab32c which is the protein that is being studied in this experiment. In this cell line, calcium is overexpressed and it is known that caffeine affects the absorption of calcium. Caffeine increased cell death, blocked early development of cells. The ddRab32c cell line acted differently than the other cell lines. Future work includes investigating the role of calcium in programmed cell death and looking for a possible connection, functional characterization of the ddRab32c protein, and studying the role of ddRab32c in programmed cell death.

37B. Examining the Antimicrobial Activity of Doped Carbon Nanoparticles. Courtney Curry, Nawab Ali. *Biology, UA Little Rock, Little Rock, AR 72204.*

Polluted water has become a major problem worldwide, and many third-world countries still face this issue today. Many experts are aiming to solve the issue of contaminated water by using a variety of processes and techniques. The techniques that are most used do not guarantee bacteria-free water. Therefore, to address this issue, phosphorus nitrogen doped carbon (PNDC) nanoparticles were tested to monitor any antimicrobial properties. Similar experiments used silver nanoparticles to successfully kill bacteria, but this experiment was to test a different chemical makeup of nanoparticles to see if the results were the same. If PNDC nanoparticles successfully killed bacteria, then they could be used as an antibacterial, cleaning agent for drinking water. This could also allow for further studies to be made to improve treatment of waterborne diseases. When PNDC nanoparticles were tested with E.coli, the E. coli was suspected to have a decline in bacteria colonial growth; however, the results showed that the PNDC nanoparticles promoted the growth of the E. coli at all concentrations, but the results showed a great deal of inconsistencies. Therefore, future studies are to be done to gain desired results.

37B. Regulation of symbiotic gene expression in rice. Ha Ram Kim, Grant Wiggins, Qinqing Yang, Jacklyn Thomas, Arijit Mukherjee. *Biology, University of Central Arkansas, Conway, AR 72035.*

Nitrogen availability is limiting to plant growth and has long been overcome through applications of nitrogen-rich fertilizer. While this has revolutionized crop yield worldwide, it has come at substantial economic, environmental, and health cost. Excess nitrogen from fertilizer run-offs in drinking water can be linked to serious health problems. One alternative is to take advantage of naturally occurring symbiotic associations between plants and bacteria that help in nutrient uptake. Plants can form beneficial associations with microbes that aid in biological nitrogen fixation for the host. For instance, major food crops (e.g., rice, corn, etc.) can form beneficial associations with nitrogen-fixing bacteria like Azospirillum and Herbaspirillum. Interestingly, these bacteria induce no specialized root

structures and use different mechanisms to colonize plant roots. Our current understanding of the molecular aspects and signaling that occur between important crops like rice and these nitrogen-fixing bacteria is limited. Our long-term goal is to characterize the genetic pathways controlling these interactions in both host and the microbe. We established an experimental system where the bacteria could colonize the plant roots and then used this colonization model to identify several host pathways that could be potentially involved in symbiosis. Specifically, we performed RNA sequencing experiments to identify the differentially expressed genes (DEGs) in rice roots during interactions with Azospirillum and Herbaspirillum at different time points. We identified 1622 and 1995 DEGs in rice roots during interactions with Azospirillum at 1 and 14-days post-treatment (dpt) respectively. During interactions with Herbaspirillum, we identified 1688 and 1515 DEGs in rice roots at 1 and 14-dpt respectively. GO analysis of the DEGs revealed that our dataset was highly enriched in genes involved in nitrate assimilation, nitrate metabolic processes, sulfur metabolic processes, etc. during rice-Azospirillum interactions. Similarly, during rice-Herbaspirillum interactions, GO analysis showed that our dataset was highly enriched in genes involved in nitrate transport and assimilation, response to chitin, polysaccharide catabolic process, hormonal signaling pathways, etc. We have already verified the expression pattern of a few selected genes from this dataset via RT-PCR. This dataset serves as an excellent resource for genetic analyses of the host pathway involved in these interactions. The replacement of fertilizers with nitrogen-fixing and plant growth-promoting bacteria could save billions of dollars per harvest. Therefore, the use and improvement of such a promising agricultural tool could provide enormous economic, environmental, and health benefits.

38B. Do Burkholderia symbiotic bacteria confer thermotolerance to their social amoeba host D. discoideum? Temilolu Adesanya, Rajheme Brown, Tammy Haselkorn. *Biology, University of Central Arkansas, Conway, AR 72035.*

Symbiosis in nature is a phenomenon where two different organisms live in a close relationship with each other, and these interactions can have profound effects for both the host and symbiont. We study the symbiotic relationship between the social amoeba D. discoideum discoideum and Burkholderia. The amoeba D. discoideum has been found to need the bacteria Burkholderia to perform a practice known as farming, which involves the transporting of bacteria food with them when their food source is low. Burkholderia infection is beneficial to the amoeba when the food source is low, however, when the food source is high there is a cost to Burkholderia infection. This relationship, like other symbioses, could be affected by many abiotic factors including temperature, which could destabilize the symbiosis. Alternatively, some bacterial symbionts allow their hosts to better tolerate heat. In our study, we hypothesize that D. discoideum infected with Burkholderia will be able to better tolerate (produce more spores) higher temperatures than uninfected D discoideum. We took 4 different clones of D. discoideum infected with different strains of the Burkholderia and measured spore production at 70 and 83 degrees Fahrenheit. We compared spore production between uninfected D. discoideum with infected D. discoideum and found that the Burkholderia helped the D. discoideum tolerate the temperature of the heated incubator better, even though the cost of having a symbiont caused a general decrease in spore production, and different strains of Burkholderia had different temperature effects. We are further exploring the effects of different temperatures and different strains of Burkholderia on spore production in D. discoideum

39A. The role of exosome-induced signaling pathways as a result of hypoxia in Glioma(U87MG) cells. Jacob Edmondson, Buzz Hardin, Raj Kore, Rob Griffin, Nathan Reyna. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

In 2015, Ouachita Baptist University (OBU) joined the AR-EPSCoR funded Center for Advanced Surface Engineering (CASE) team. This project focused on the use of RNA sequencing and gene expression to help understand the genetic signals involved with neuron differentiation. Exosomes are small membrane-bound vesicles released by cells that have been shown to carry genetic material and proteins that may act as a cell signaling mechanism controlling the differentiation of surrounding cells. Glioma cells (U87MG) were grown under hypoxic conditions. Exosomes from treated cells were then isolated and added back to untreated U87 cells. Global gene expression analysis was then conducted to identify novel signaling pathways. After RNA Seq analysis, signaling pathway analysis was conducted to explore gene ontology change induced in the sample that was exposed to hypoxia-induced exosomes. Pathway analysis suggested that the repressed activity of genes KCNJ3 and KCNJ8, which both code for potassium ion channels, shows that the impact of the exosome intracellular communication is seen strongly at the synapse and in cellular defense mechanisms. Other pathways were found in relation to repression of the CBS gene, which can cause a decrease in the metabolism of essential amino acids, and even alter the motor cortex. U87MG glioma gene ontology changes due to the exposure to exosomes can present possible cellular mechanisms that allow cancer cells to have increased viability under hypoxic conditions.

39B. Early development of Arabidopsis thaliana in Possible Spaceflight Conditions of Low Pressure and Altered Oxygen and Carbon Dioxide. Nathan Terry, Brittany Beaver, Jim Taylor. *Biology, Ouachita Baptist University, Arkadelphia, AR 71998.*

Man has always been drawn to the mystery of space, but space travel is a challenging task due to lack of resources, such as energy, oxygen, and available space. The use of the plant Arabidopsis thaliana is an excellent test subject because of its relative short life cycle and it not needing much space. In this experiment, Arabidopsis was grown from seeds for two weeks in hypobaric chambers at approximately 50% Earth's atmosphere and were attached to clinostats. For the first week, additional O2 was added to one of the hypobaric chambers. Similarly for the second week additional CO2 was added to the one chamber. After the two weeks the root length, stem rate, leaf area and electron transport rate was measured to compare the differences of the plants grown in the chamber that was exposed to additional CO2 & O2 to a chamber not exposed to additional gasses.

40A. Soil Crust Algal Communities of Warren Prairie Natural Area. A.L. Gray, C. Haynes, R.E. Knight, Caleb Lamb, *Math and Natural Science, UA Monticello, Monticello, AR 71655;* B. Baker, *Arkansas Natural Heritage Commission, Little Rock, AR 72201.*

Warren Prairie Natural Area in Bradley and Drew Counties, Arkansas, is a mosaic of saline slicks that form flat, crusty depressions with a zone of lichens and a few rare angiosperms at its edge, and a large outer zone of cryptogamic mats, including the cyanobacterium, Nostoc. These saline slicks are surrounded by prairie grasses and are flanked by pine flatwoods, often with an understory layer of dwarf palmetto. The edges of the saline slicks are home to the rare, diminutive vascular plant, Geocarpon minimum Mackenzie (Caryophyllaceae), which is a federally protected species that is tracked by botanists at the Arkansas Natural Heritage Commission. The main objective of this project was to characterize the soil crust eukaryotic algal communities in Warren Prairie Natural Area using morphological and molecular techniques. We collected soil crust samples from two sites in Warren Prairie Natural Area in February 2016. Site 1 was on the south side of a saline slick (where Geocarpon minimum was not present). Site 2 was on the north side of the same saline slick (with Geocarpon minimum present). Three soil samples were collected at each site from: 1) the inner slick; 2) mid-crust layer with lichens and a few angiosperms; and 3) the outer layer of algal mats. Unialgal strains were isolated from the soil samples and characterized by light microscopy. Forty-five strains were isolated from Site 1 (without G. minimum) and thirty-four strains were isolated from Site 2 (with G. minimum). We selected 20 strains from each site for molecular characterization based on initial microscopic examination. Ribosomal 18S or rbcL DNA sequences were generated from the strains and BLASTN was used to identify each strain. We have characterized some algae from the Chlorophyta, Xanthophyceae and Eustigmatophyceae. The Eustigmatophyceae isolates include three different members of the Eustigmatos/Vischeria group, two of which are likely new species. Further characterizations may reveal additional new taxa.

40B. Soil Crust Algal Communities of Warren Prairie Natural Area. A.L. Gray, C. Haynes, Rachel E. Knight, Caleb Lamb, *Math and Natural Science, UA Monticello, Monticello, AR 71655;* B. Baker, *Arkansas Natural Heritage Commission, Little Rock, AR 72201.*

Warren Prairie Natural Area in Bradley and Drew Counties, Arkansas, is a mosaic of saline slicks that form flat, crusty depressions with a zone of lichens and a few rare angiosperms at its edge, and a large outer zone of cryptogamic mats, including the cyanobacterium, Nostoc. These saline slicks are surrounded by prairie grasses and are flanked by pine flatwoods, often with an understory layer of dwarf palmetto. The edges of the saline slicks are home to the rare, diminutive vascular plant, Geocarpon minimum Mackenzie (Caryophyllaceae), which is a federally protected species that is tracked by botanists at the Arkansas Natural Heritage Commission. The main objective of this project was to characterize the soil crust eukaryotic algal communities in Warren Prairie Natural Area using morphological and molecular techniques. We collected soil crust samples from two sites in Warren Prairie Natural Area in February 2016. Site 1 was on the south side of a saline slick (where Geocarpon minimum was not present). Site 2 was on the north side of the same saline slick (with Geocarpon minimum present). Three soil samples were collected at each site from: 1) the inner slick; 2) mid-crust layer with lichens and a few angiosperms; and 3) the outer layer of algal mats. Unialgal strains were isolated from the soil samples and characterized by light microscopy. Forty-five strains were isolated from Site 1 (without G. minimum) and thirty-four strains were isolated from Site 2 (with G. minimum). We selected 20 strains from each site for molecular characterization based on initial microscopic examination. Ribosomal 18S or rbcL DNA sequences were generated from the strains and BLASTN was used to identify each strain. We have characterized some algae from the Chlorophyta, Xanthophyceae and Eustigmatophyceae. The Eustigmatophyceae isolates include three different members of the Eustigmatos/Vischeria group, two of which are likely new species. Further characterizations may reveal additional new taxa.

41A. Optimization for Arthroscopic Rotator Cuff using Generative Anatomy Modeling Language. Doga Demirel, *UA Little Rock, Little Rock, AR 722204,* Seth Cooper-Baer, Jake Farmer, Tansel Halic, Sinan Kockara, *Computer Science, University of Central Arkansas, Conway, AR 72035,* Shahryar Ahmadi, *UAMS, Little Rock, AR 72205.*

This study presents optimization used for creation of difficulty scenarios for virtual simulation of Arthroscopic Rotator Cuff repair surgery using our Generative Anatomy Modeling Language (GAML) framework. Arthroscopic Rotator Cuff surgery is a surgical procedure in the shoulder performed through tiny scalpel incisions. Although there exist challenges in skill requisition for ARC, there is no standard training or assessment platform. We are developing a virtual simulation of the Arthroscopic Rotator Cuff surgery supporting different difficulty scenarios.
GAML framework supports geometry modification commands that were used to perturb the base 3D models of the shoulder anatomy and generate rotator cuff tears. While focusing on the 3D model generation, our GAML framework handles the validity of the generated scenario with the given constraints of the shoulder anatomy. These constraints ensured that output is not irrational and the geometry modifications (e.g. translation, deformation) remain within the desired or acceptable level of accordance with the shoulder anatomy. Some of the constraints consist of, angle, absolute distance, and flexibility. Our constraints are directly applied in the non-linear optimization model. The geometry commands in our framework finds optimum solution to the non-linear optimization problem and satisfy the anatomical constraints at all times.

41B. Energy Availability in Polyglutamine Proteotoxicity in C. elegans. Landon Gatrell, Brandon Purcella, Mindy Farris, *Biology, University of Central Arkansas, Conway, AR 72035.*

Alterations in protein folding may lead to aggregation of misfolded proteins, ultimately leading to toxicity and cell death. Protein aggregation has been shown as a normal consequence of aging, but it is largely associated with age-related disease, particularly neurode-generative diseases like Alzheimer Disease (AD) and Huntington Disease (HD). Under normal circumstances, glucose enrichment shortens the lifespan of the model organism Caenorhabditis elegans; however, recent research suggests that glucose actually provides some protection against cell stress, including proteotoxicity related to aggregation. Huntington Disease is a useful model for neurodegenerative research, as it is strictly genetic and caused by mutation of a single gene. We will investigate glucose-mediated neuroprotection against Huntington Disease phenotypes in polyglutamine models of C. elegans including accumulation of ubiquitin-tagged protein aggregates and cell death.
Our results show that NGM plates with 2% glucose is not sufficient to provide a protective effect in the AM101 strain of C. elegans, where the polyglutamine repeat (the causal mutation in HD) is expressed in the neurons. More recent experiments use 2.8% glucose plates with the AM101 strain. We plan to use differing strains of C. elegans to compare polyglutamine proteotoxicity in neurons and proteotoxicity in muscle cells, which is another common neurodegenerative model.
Neurodegenerative diseases represent a significant threat to national health and healthcare expenses. By understanding the mechanisms behind glucose-mediated neuroprotection, we can begin to understand the underlying toxic factors present in HD, which are currently unknown, and potentially isolate target areas for treatment of HD.

42A. Developing a Burrowing Assay with Caenorhabditis elegans. Erika Levy, Brenda Houck, *Biology, Hendrix College, Conway, AR 72032.*

With a fully mapped genome and a large portion of genes homologous to humans, Caenorhabditis elegans are exceptionally useful in studying various human conditions, including neuromuscular disorders. Such research becomes more robust, as we increase our understanding of C. elegans behavior and variation across mutant strains. Much of the existing research analyzes changes in movement using nematode crawling behavior. However, when in nature, nematodes spend much of their time burrowing in the soil, meaning this behavior is important for identifying subtle phenotypic variations across mutant strains. Identification of phenotypic differences will inform our understanding of which genes are involved in which behavioral changes. This project provides a detailed methodology for a burrowing assay, which was first introduced at The University of Texas at Austin. In this study, we implemented the burrowing assay to better understand if C. elegans require specific gap junctions, composed of innexin proteins, to generate appropriately timed head movement while burrowing. In developing this assay, we compared the burrowing movement of two mutant strains containing innexin protein deletions in the head/neck region, XM1011 and RB1792, with wild-type worms. Analysis of their burrowing movement compared to the wild-type provides important insight into movement control of C. elegans, which will contribute to our understanding of vertebrate movement.

42B. Helicobacter Pylori Biofilm Formation via Flagella Motility. Scotty Merrell, Brittany Northern, Stephanie Servetas, Ian Windham. *Biology, Lyon College, Batesville, AR 72503. (Research performed at Dr. Merrell Lab at Uniformed Services, University of the Health Sciences in Bethesda, MD).*

Helicobacter Pylori, HP, a gram-negative, helical bacterium, has been around for much longer than the time it was most recently discovered (1982). The biggest symptoms of the bacteria are gastritis, gastric ulcers, and, in some strains, gastric carcinoma. Since the discovery, there have been a very large number of medical cases founded from all around the world. Most of the places affected by HP are in lower developing countries, and this is most likely from lack of clean water. The biggest issue with HP is that they are very likely to become antibiotic resistant, as with many bacteria. This has already began to happen, so research has been centralized on trying to understand HP more generally so that we can target what will be the most effective ways to kill the bacteria quickly and efficiently. In the colonization of HP, it is thought that the bacteria produce a biofilm around the cells to form another barrier against any invading substances, such as antibiotics. In the Merrell lab, extensive work has been performed to expose the biofilm founded from HP. The experiments have been successful in showing the biofilm formation. We hypothesize that the flagella in HP helps the bacteria to colonize. The colonized bacteria are then able to produce biofilm. In our research during the summer of 2017, we focused on trying to understand several strains of HP that have mutations to either produce no flagella or paralyzed flagella, by complementing the gene back into the mutated cell, and then attempted to experiment with the biofilm formation of each. Along with this, we also performed an experiment to see if we could isolate a frame shift mutated cell of a strain, which is found to produce small amounts of motile cells in a colony of predominately non-motile cells, and then produce evidence of biofilm formation to test our hypothesis.

43A. Evaluating the Taxonomic Status of Arkansas Twistflower, Streptanthus maculatus subsp. obtusifolius and Clasping Jewel Flower, Streptanthus maculatus subsp. maculatus (Brassicaceae). Leila Henning, J.A. Magana, V. Mendoza, B. O'Neal III, K.P, Fawley, M.W. Fawley, *Math and Natural Science, UA Monticello, Monticello, AR 71655;* B. Baker, *Arkansas Natural Heritage Commission, Little Rock, AR.*

The objective of this study was to use DNA sequence data to determine if Streptanthus maculatus Nuttall subsp. obtusifolius Hook (Rollins) (Arkansas twistflower) and S. maculatus subsp. maculatus Nuttall (clasping jewel flower) in the mustard family (Brassicaceae) are actually subspecies. Streptanthus maculatus subsp. obtusifolius is endemic to Arkansas, whereas S. maculatus subsp. maculatus is found in a few counties in Oklahoma and Texas. Streptanthus maculatus has been divided into subspecies maculatus and subspecies obtusifolius based on leaf shape and the presence or absence of subapical callus on sepals. A different interpretation of the morphological and geographical data suggests that S. maculatus subsp. obtusifolius and S. maculatus subsp. maculatus may be separate species. Are Streptanthus subsp. obtusifolius (Arkansas twistflower) and S. maculatus subsp. maculatus (clasping jewel flower) subspecies? This research question was evaluated by the 2017 UAM- Research Program for Minority Students (UAM-RPMS) Research Experience class. The students performed a preliminary evaluation of this question by producing nuclear ribosomal ITS DNA sequences from specimens of Steptanthus maculatus subsp. maculatus, S. maculatus subsp. obtusifolius and two related species, S. hyacinthoides and S. squamiformis. The students compared these sequences to published sequences of S. maculatus subsp. maculatus and other related species of Streptanthus. Our results suggest that S. maculatus subsp. obtusifolius is intermediate between S. squamiformis and the published specimens of S. maculatus subsp. maculatus. Also, the Oklahoma specimen of S. maculatus subsp. maculatus (Baker 12-0030) is resolved as distinct from the published specimens, which are likely from a Texas population. S. maculatus subsp. maculatus may actually be a stable hybrid between the Oklahoma population of S. maculatus subsp. maculatus and an unknown parent.

43B. Evaluating the Taxonomic Status of Arkansas Twistflower, Streptanthus maculatus subsp. obtusifolius and Clasping Jewel Flower, Streptanthus maculatus subsp. maculatus (Brassicaceae). Leila Henning, J.A. Magana, V. Mendoza, B. O'Neal III, K.P, Fawley, M.W. Fawley, *Math and Natural Science, UA Monticello, Monticello, AR 71655;* B. Baker, *Arkansas Natural Heritage Commission, Little Rock, AR.*

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twistflower) and S. maculatus subsp. maculatus (clasping jewel flower) subspecies? This research question was evaluated by the 2017 UAM- Research Program for Minority Students (UAM-RPMS) Research Experience class. The students performed a preliminary evaluation of this question by producing nuclear ribosomal ITS DNA sequences from specimens of Steptanthus maculatus subsp. maculatus, S. maculatus subsp. obtusifolius and two related species, S. hyacinthoides and S. squamiformis. The students compared these sequences to published sequences of S. maculatus subsp. maculatus and other related species of Streptanthus. Our results suggest that S. maculatus subsp. obtusifolius is intermediate between S. squamiformis and the published specimens of S. maculatus subsp. maculatus. Also, the Oklahoma specimen of S. maculatus subsp. maculatus (Baker 12-0030) is resolved as distinct from the published specimens, which are likely from a Texas population. S. maculatus subsp. maculatus may actually be a stable hybrid between the Oklahoma population of S. maculatus subsp. maculatus and an unknown parent.

44A. Virtual Arthroscopic Tear Diagnosis and Evaluation Platform. Doga Demirel, Seth Baer, Mustafa Tunc, Jake Farmer, Tansel Halic, Sinan Kockara, Shahryar Ahmadi. *Computer Science, University of Central Arkansas, Conway, AR 72035; Computer Science, UA Little Rock, Little Rock, AR 72204; Department of Orthopedic Surger, UAMS, Little Rock, AR 72205.*

Arthroscopic surgery is a minimally invasive surgery to diagnose and treat issues, most often within a joint. Training for arthroscopic surgery is difficult due to limited field of view, as well as non-natural hand-eye coordination. Typical training systems for this type of surgery, such as cadavers, mannequins, and apprenticeships in the operating room have limited use, high cost, high risk, and do not always give a realistic experience. A Virtual Reality (VR) training simulator gives a low-cost, risk-free platform for assessment and training of novice surgeons. These qualities allow for improved operating room performance, and provide a reusable platform for constant refinement of skills. We are developing a VR based shoulder arthroscopy simulation specifically targeting rotator cuff repair. The Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP) allow surgeons to obtain quantitative feedback on their performance automatically, through validated metrics, without su pervision or manual scoring by expert surgeons. VATDEP also focuses on visual realism, along with the use of human analogues to provide physical realism as well. We envision that our simulation will provide a time and cost effective alternative to the current training methods for novice surgeons focused on rotator cuff repair. In this work, we describe the VATDEP platform and ongoing work about the simulator.

44B. Cognitive and Motor Task Switching Networks in Parkinson's Disease. Kori Maloy, Amrita Puri, Elizabeth Disbrow, Christina Ledbetter. *Biology, University of Central Arkansas, Conway, AR 72035.*

Parkinson's Disease (PD) is well-known to impair motor movements due to the loss of neurons in the substantia nigra. These cells are responsible for the release of dopamine, which plays a role in the control of movement and coordination. Set switching deficits, or impairments in the ability to shift focus between one task and another, have been described in PD patients in relation to both motor and cognitive tasks. Here, we used fMRI to explore the brain networks involved in motor and cognitive switching in participants with PD in comparison to a healthy control group. The PD subjects were early stage, on their medication, right side dominant, and right-handed. The trials entailed a colored (pink or yellow) shape (square or circle) with a word cue above it. The cues indicated the stimulus attribute to be identified ("COLOR" or "SHAPE"; adapted from Shook et al., 2005). The participants used their right hand to press the l eft button to indicate "square" or "yellow" or the right button for "circle" or "pink." Subsequent trials consisted of a new colored shape (always a yellow or pink square or circle) and cue (color or shape), and could involve no switch (same button and same cue), a motor switch (different button), and/or a cognitive switch (different cue) in comparison to previous trials. The brain images were acquired on a 3T Siemens Trio MRI scanner using a gradient-echo echoplanar imaging pulse sequence and high-resolution, T1-weighted anatomical MP-RAGE sequence. The statistical analysis was performed using SPM8 and AFNI. In the control group, comparing the fMRI activity between the motor switch and non-switch trials revealed activity in the superior and middle frontal gyri (SFG/MFG), right inferior frontal gyrus (rIFG) and the caudate nucleus. However, the PD group presented reduced activity in the left insula for motor switching, with greater rel ative activity in the rIFG and left premotor cortex compared to the control group. In comparison to the non-switch trials, increased activity in SFG/MFG as well as the left insula, putamen, anterior cingulate (ACC), precuneus, and premotor cortex was found in the trials involving cognitive switching. In PD compared to controls, activity was decreased in the left insula, similar to the motor switching condition, as well as in the ACC and caudate nucleus. Our results suggest that motor and cognitive switching engage partially overlapping neural networks involving frontal and striatal regions. Cognitive switching activated the insula, anterior cingulate, and precuneus, while motor switching involved the IFG. The PD group showed relative underactivation in the insula, a region known to be involved in task switching, for both types of switching. This underactivation in the PD group may

reflect deficits in cognitive control networks involved in task switching and response selection.

45A. Evaluation of Ryanodine Receptors in Lymphatic Muscle Cells. Michelle Everett, Brittney Garner, Terry W. Fletcher, Amanda Stolarz, Nancy Rusch. *Biology, Mississippi College, Clinton, MS 39058; UAMS, Little Rock, AR 72205.*

Lymphedema is the accumulation of protein-rich fluid in interstitial tissue that results from inadequate lymphatic drainage. Lymphedema either can be caused by genetic factors or develop secondarily to cancer treatments including surgery, radiation, and chemotherapy. Importantly, lymphedema may become irreversible and no pharmacological therapies are available to treat it. The lymphatic system normally maintains fluid homeostasis by spontaneous rhythmic contractions of lymph vessels, which return lymph fluid from the tissues to the central venous circulation. These spontaneous contractions critically rely on the cyclic elevation of calcium in lymphatic muscle cells (LMCs). Thus, activation or inactivation of calcium channels in LMCs can have profound effects on lymphatic contractions. Most studies have focused on the contribution of voltage-gated calcium channels in the plasma membrane to lymphatic contractile function, and largely ignored the ro le of intracellular ryanodine receptors (RyRs), which are calcium-release channels located in the sarcoplasmic reticulum (SR). In this study, we evaluate the expression of RyRs in LMCs. The relative abundance of the three RyR isoforms (RyR1, RyR2, RyR3) is tissue- specific; however, based on previous reports suggesting LMCs are an unique hybrid of striated and smooth muscle, we hypothesized that all three RyR isoforms are expressed by LMCs. To test this hypothesis, we will use immunocytochemistry, Real-Time Polymerase Chain Reaction (RT-PCR), and Western blot to establish which RyRs isoforms are present in the LMCs of rat mesenteric lymph vessels.

45B. A Possible Role of Mcm10 in DNA Damage Response Pathway. Sarah Woller, M. Shaw, J. Baer, T. Noble, S. Das-Bradoo. *Natural Science, Northeastern State University, Tahlequah, OK 74464.*

DNA in our cells is continuously subjected to endogenous and exogenous damage. Our cells respond by activating the DNA Damage Response (DDR) pathway, which then leads to repair of the damaged DNA. Mutations in the DDR pathway can cause genomic instability and frequently lead to cancer. Minichromosome maintenance 10 (Mcm10) is required for both initiation and elongation steps during DNA replication. However, Mcm10's role in the DDR pathway is not known. Previous work in our laboratory has shown that Mcm10 interacts with Maintenance of Replication Checkpoint 1 (Mrc1) through yeast-two-hybrid. Mrc1 is critical for the DDR pathway by recognition of DNA damage and activation of the S-phase checkpoint. We have observed that this interaction between Mcm10 and Mrc1 occurs through the C-terminus region of Mrc1. Our project attempts to further narrow down the region of interaction on Mrc1. To accomplish this, we have successfully constructed truncated Mrc1 (498-1096) in a yeast-two-hybrid vector. Western blot has confirmed the expression of this truncated protein. Results from the interaction studies will be presented at this meeting. The long term goal of the project is to disrupt Mcm10:Mrc1 interaction and then study the yeast for cell cycle and growth phenotype defects.

46A. Evaluating the Taxonomic Status of Arkansas Twistflower, Streptanthus maculatus subsp. obtusifolius and Clasping Jewel Flower, Streptanthus maculatus subsp. maculatus (Brassicaceae). Leila Henning, J.A. Magana, V. Mendoza, B. O'Neal III, K.P, Fawley, M.W. Fawley, *Math and Natural Science, UA Monticello, Monticello, AR 71655;* B. Baker, *Arkansas Natural Heritage Commission, Little Rock, AR.*

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specimens, which are likely from a Texas population. S. maculatus subsp. maculatus may actually be a stable hybrid between the Oklahoma population of S. maculatus subsp. maculatus and an unknown parent.

46B. Role of Infant Diet in Gastrointestinal Tract Development. Allie Wynn, Laxmi Yeruva. *Mathematics, UA Monticello, Monticello, AR 71655; Dept. of Pediatrics, Section of Developmental Nutrition, UAMS, Little Rock, AR 72205.*

Although the numerous health benefits of breastfeeding are well documented, the mechanisms, including how neonatal diet (breastmilk or formula) impacts the microbiome and how the microbial shifts impact gut metabolic physiology and immune system, behind them are not fully known. It has been recently documented that neonatal diet has distinct regional effects on the small intestine microbiome, with the most evident diet-associated effects in the duodenum. The question arises as to what are the specific genera and what is the microbial abundance and colonization of the specific genera of the duodenum post weaning the diets in various neonatal diet groups. Upon extraction of duodenum contents from sow-fed, human breastmilk-fed, and formula-fed piglets and the subjection of these contents to DNA isolation and sequencing, thorough analysis must be conducted to determine the microbial abundance and colonization of the determined specific genera. The data is analyzed using an open source platform, DAME (Dynamic Assessment of Microbial Ecology), that uses R version 3.2.1 to perform microbial ecology data analyses by assessing measurements of α-diversity and β-diversity and differential expression analyses of count data. Upon describing α-diversity using measurements such as total Operational Taxonomic Units (OTUs), Chao1, and the Shannon Index with group differences assessed by analysis of variance (ANOVA) and assessing β-diversity by calculating distance and dissimilarity metrics with group differences assessed by permutational multivariate analysis of variance (PERMANOVA), the persistent effect of neonatal diet in duodenum microbial colonization is determined. Future studies will be conducted to understand the specific role of microbiome in gut immune system development and gut physiology.

47A. Effects of a RAS inhibitor and Its Combination with Proteasome Inhibitor on Multiple Myeloma. Sawyer Hickey, *Biology, University of Central Arkansas, Conway, AR 72035;* Donghoon Yoon, *Myeloma Institute, UAMS, Little Rock, AR 72205.*

Multiple Myeloma (MM), the second most common form of blood cancer, is indicated by abnormal proliferation of plasma cells in bone marrow, presence of a monoclonal serum immunoglobulin, and osteolytic lesions. Significant improvements of MM treatment and survival were made in the last few decades, yet MM is still considered to be an incurable disease due to relapse and drug resistant patients. Proteasome inhibitors are broadly effective on the majority of MM patients. However, relapsed patients and/or resistant patients exist. RAS genes encode a family of small GTPase proteins ubiquitously expressed in all cell lineages transmitting signals for cell growth, differentiation, and survival. RAS mutations are rarely found in pre-malignant stages, with mutations in RAS genes leading to activated RAS signaling, resulting in cancer. In MM, RAS pathway mutations are highly prevalent in newly diagnosed patients, at 43%, with increased prevalence of RAS pathway mutations in up to 72% of patien ts with relapsed or refractory disease. These results indicate RAS mutations may play significant roles in malignant transformation of MM. Rigosertib is a RAS-specific inhibitor and targets cancer cell division; Rigosertib binds directly to the RAS-binding domain in RAS-effector proteins disrupting RAS/effector interactions. Regosertib effect on MM has not been tested. We tested the effects of carfilzomib and rigosertib on various MM cells (5TGM1-mouse-MM cell, RPMI-8226-human-MM cell with TP53, K-Ras & EGFR mutations, H929-human-MM cell with t(4:14) and mutated Ras) using a CellTiter-Glo-2.0 Proliferation Assay and found decreased cell proliferation in all tested MM cells in a dose-dependent manner. A combination study of these two drugs is currently ongoing. Once this study is concluded we will test the most effective combination in a MM preclinical model. Such combination may reduce required drug concentrations, thus decreasing adverse effects seen by using high drug concentr ations.

47B. Bottom-up vs. Top-down Processing in Individuals with Autism Spectrum Disorder. Taylor Dague, Kenith Sobel, Kami Koldewyn, Amrita Puri. *Biology, University of Central Arkansas, Conway, AR 72035.*

Autism Spectrum Disorder (ASD) is categorized by an array of conditions involving behavioral, social, cognitive, and perceptual abnormalities. Previous research on ASD has emphasized the importance of identifying essential components of perceptual and sensory processing that differ between individuals with ASD and typically developing individuals (Dakin & Frith, 2005; Simmons, Robertson, McKay, Toal, McAleer, & Pollick, 2009). Individuals diagnosed with ASD perform differently than neurotypical (NT) individuals on a variety of perceptual tasks, including visual search (Joseph, Keehn, Connolly, Wolfe, Horowitz,2009). Perceptual processing theories attribute these task differences to abnormalities in bottom-up (e.g., incoming sensory stimuli) or top-down (e.g., cognitions or expectations) processing (Happe, Frith, 2006). Here, a visual search task was used to determine if individuals

with ASD differ from NT individuals in their utilization of to p-down strategies versus bottom-up information. Participants (young adult individuals with ASD and neurotypical controls) completed a task in which they searched for a red horizontal target among red tilted and green horizontal distractors. To manipulate the salience of bottom-up features, we varied the ratio of distractor types (red tilted vs. green horizontal). The "distractor ratio effect" predicts that when either distractor group is small, reaction times (RT) are fastest (Bacon & Egeth, 1997). Because here, red distractors comprised the smaller distractor group on most trials, a top-down strategy of grouping by color was advantageous. To further manipulate the salience of bottom-up features, we also varied the degree to which distractor orientation, or angle, differed from that of the target. Both ASD and NT participants exhibited the "distractor ratio effect". Furthermore, both participant groups seemed to favor searching by color when the differenc e between the target and distractor orientation was small, indicating similar utilization of a top-down strategy by both groups. Faster RTs for individuals with ASD on trials where the target's orientation differed from distractors only slightly suggest stronger bottom-up visual capture in ASD compared to NT individuals. Our results are consistent with Happe and Frith (2006) who suggest that bottom-up signals are stronger than normal in individuals with ASD, and the hypersensitivity to sensory stimuli often experienced by ASD individuals (Baron-Cohen, Ashwin, Ashwin, Tavassoli, & Chakrabarti, 2009; Rogers & Ozonoff, 2005).

48A. A Graphical Approach to Comparison of qnrS-Carrying Plasmid Sequences. Sarah Cruz, John de Banzie, Cindy Cisar. *Natural Sciences, Northeastern State University, Tahlequah, OK, 74464.*

Antibiotic resistance in bacteria is a growing problem in health care. Bacteria become antibiotic resistant by mutation or by acquiring resistance genes from their environment. A possible anthropogenic source of antibiotic resistance genes is effluent from wastewater treatment plants. Effluent may contain resistant bacteria, resistance genes, and/or antibiotics. To assess this source fluoroquinolone-resistant bacteria have been isolated from effluent from a wastewater treatment plant, from the river upstream of the discharge point, and from the river downstream of the discharge point. In some cases fluoroquinolone resistance is due in part to plasmids carrying a qnrS2 gene. Sequencing of these plasmids has shown that they are related to previously-reported plasmids from diverse locations in complex ways. We are exploring a graphical approach to displaying sequence comparisons. The plasmid sequence is broken into sequential 200 nucleotide pair segments. Each segment is used for a BLAST search and the top ten hits recorded. The region of homology between the original plasmid and each of the top hits is determined by Pustell DNA matrix and entered into an Excel spreadsheet for graphical display. We hope this approach may make the relationships between plasmids more understandable.

48B. Investigating the Mcm10-Polymerase Epsilon Interaction Using the CRISPR-Cas9 System. Batuel Okda, Casey Eddington, Sapna Das Bradoo, Brandon Curry. *Natural Sciences, Northeastern State University, Tahlequah, OK 74464.*

Mutations associated with Mcm10 and polymerase epsilon are associated with several health disorders including cancer and congenital diseases. Polymerase epsilon, a key enzyme involved in replication, has shown to interact with Mcm10 in past research. The scope of this project is to introduce mutations in endogenous polymerase epsilon at locations experimentally found in our lab to interact with Mcm10. We hypothesize that the mutant yeast cells will exhibit growth defects due to abrogation of Mcm10 and polymerase epsilon interaction.
We are using the CRISPR-Cas9 system to introduce mutations on the yeast genome that codes for a region of polymerase epsilon that interacts with Mcm10. CRISPR-Cas9 is a technique evolved from bacterial defenses against invading viruses. Using this procedure, a section of a genome can be targeted and replaced in a very efficient manner. The sequence being inserted can have mutations not found in the wild type, and this allows researchers to observe phenotypic outcomes in the presence of the mutations.
This technique involves two steps: creation of a Cas9-gRNA plasmid and then target the budding yeast genome by homologous recombination. We have successfully constructed a CRISPR-Cas9 Pol2 gRNA plasmid in the laboratory and inserted the mutations into the yeast genomic DNA. Agarose gel electrophoresis and colony PCR verify ligation. PCR was ran to verify the insertion of the mutations. An 80mer with mutations (Pol2 GE1425, 1428AA), also based on Pol2 subunit, was created. Both the plasmid and the 80mer were transformed into yeast cells where the gRNA will assist in inserting the 80mer into yeast genome through homologous recombination. The mutation was successfully inserted.

49A. Thymoquinone induces apoptosis in murine squamous cell carcinoma (SCC VII) cells through ROS induction and glutathione depletion. Malcolm Anderson, Selma Dagtas. *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Oral cancer is a challenging medical problem with disappointing survival rates. Despite the successful treatment of the initial lesion, new lesions appear under the influence of the same predisposing factors that

caused the initial lesion at the first place. Leukoplakia is a clinical condition characterized by pre-malignant gray or white patches of the oral mucosa. As one fourth of these cases are dysplastic, they are removed with surgery. About 8-15% of the remaining cases may undergo cancerous transformation. Treatment of these lesions is difficult because there is no effective chemotherapy and surgery is not justified for widespread lesions. Many cases are simply followed without intervention. Development of tolerable, non-toxic treatment agents that would prevent the occurrence of new lesions from the affected mucosa following the treatment of an initial lesion would improve the survival rates of oral cancer.
There is growing interest in naturally occurring phytochemical compounds over the recent years. Compared to conventional anti-cancer medications, natural compounds are relatively non-toxic and inexpensive. Nigella sativa, also known as the black seed or black caraway, is an herb that has attracted attention with its anti-cancer, anti-inflammatory, immune-modulatory, anti-allergic and anti-oxidant effects. The best studied bioactive component of the N. sativa oil, thymoquinone, has been shown to have anti-cancer effects on many cancer types in in vitro and in vivo studies.
In this study, thymoquinone resulted in apoptosis in murine squamous cell carcinoma (SCC VII) cells and human leukoplakia (LEUK 1) cells in vitro. Thymoquinone induced cytotoxicity was prevented by n-acetyl cysteine as well as glutathione ethyl ester (bioavailable form of glutathione) treatment. Glutathione was decreased and reactive oxygen species (ROS) were increased in thymoquinone treated cells. These findings suggest that thymoquinone induced cytotoxicity in SCC VII cells were mediated by ROS induction and glutathione depletion.

49B. The presence of serum diminishes the effectiveness of α-hederin in murine squamous cell carcinoma (SCC VII) cells. Summer Harris, Selma Dagtas. *Biology, UA Pine Bluff, Pine Bluff, AR 71601.*

Oral cancer treatment is far from satisfactory with a five-year survival rate of 40-60%. Over 90% of the oral cancers are squamous cell carcinomas. New lesions usually appear following the removal of the initial lesion by surgery, necessitating a preventive, non-toxic chemotherapy to control new and spreading disease following surgery on the primary lesion.
Natural compounds represent relatively non-toxic and inexpensive alternatives for conventional chemopreventive therapeutics. The seeds of Nigella sativa represent an herb already used to treat a broad array of diseases and routinely used as spice in Indian and Middle Eastern cuisines. The N. sativa herb has attracted considerable attention with anti-cancer, anti-inflammatory, immune-modulatory, anti-allergic and anti-oxidant effects. In our laboratory, a water-based whole N. sativa seed extract was found to inhibit cell viability in murine squamous cell carcinoma (SCC VII) cells in vitro. Among the known bioactive compounds N. sativa contains, α-hederin was found to be the effective compound in the water extract. However, IC50 of α-hederin was considerably higher than what is reported in the literature on different cell types.
In this study, we compared the IC50 of α-hederin in the presence and absence of serum in murine squamous cell carcinoma (SCC VII) cells. IC50 of α-hederin in the absence of serum was about 10 times lower suggesting that α-hederin is bound by serum proteins.

50A. The Effect of Microgravity on Vascular Tone in Female Mice. Sage Shaddox, Graduate Student Presenter, Brent Hill. *Biology, University of Central Arkansas, Conway, AR 72035.*

Hind limb unloading (HLU) is a laboratory technique that can be used to stimulate microgravity, or reduced gravity in rodents. Microgravity research using HLU has been extensively studied since the 1980s generally focusing on bone decalcification, and cardiovascular deconditioning. Microgravity has shown to decrease the contractile response in blood vessels, particularly the abdominal aorta. These studies generally used male rodent models and have not evaluated the impact of in vivo estrogen on female cardiovascular function. Once females undergo menopause gonadal estrogen production decreases, or halts all together significantly increasing the risk for cardiovascular disease and dysfunction. With the ever growing interest in colonizing Mars, the effects of long term microgravity exposure in women needs to be studied. The purpose of this study is to observe the effects of microgravity on the contraction and relaxation of the abdominal aorta between control (SHAM) and ovariectomized (OVX) female mice. This study will determine the difference between heart size, plasma estradiol concentration, and lean mass acclimation.

50B. Dynamic Voxelization for Virtual Rotator Cuff Surgery. Mustafa Tunc, Doga Demirel, Tansel Halic, Sinan Kockara, Shahryar Ahmadi. *Computer Science, University of Central Arkansas, Conway, AR 72035; Orthopedic Surgery, UAMS, Little Rock, AR 72205.*

Arthroscopy is a minimally invasive surgical procedure for diagnosis and treatment of joints. Arthroscopic Rotator Cuff (ARC) is a surgical treatment for group of muscles and tendons that connect the upper arm to the shoulder blade. Training for ARC is challenging due to constrained instrument controls, non-natural hand-eye coordination and limited field of view. Besides, conventional methods such as cadavers, apprenticeship and mannequins make the training costly, risky and non-realistic. In contrast, Virtual Reality (VR) based surgical

simulators offer low-cost, risk-free and realistic training and assessment platform. We have been developing a real-time VR based ARC simulation and drilling a suture anchor into the humeral head is one of the decisive tasks. Common techniques used for drilling simulation are not sufficient to reflect the realism and do not deliver optimal performance required for the real-time interaction in a virtual simulator. In order to achieve a performant hig h realism, a dynamic voxel based method is developed.
Although voxels have many advantages such as easy surface creation, robust haptic interaction and low memory usage, an accurate geometric representation requires extremely small voxel sizes. However, higher resolution entails significant computation. Instead, we developed a novel method based on Dynamic Proximity Hierarchy (DPH) which is a graph spanner based hierarchical map of approximate shortest paths of the point in the 3D geometry (e.g. Shoulder Anatomy). Using DPH, the sizes of the voxels can be adjusted to the appropriate resolution or level of detail in real time. The level of the adjustment can be dynamically performed based on proximity of the voxels interacting with a shaver or drilling instrument or the field of view without extra surface generation. Since DPH serves a computationally efficient interaction and visual rendering, visualization and haptic rate can be rendered at real time rates (e.g. 60 Hz and 1Khz respectively) with higher resolution than a rendering witho ut DPH. In this work, we present the details of our algorithm and preliminary results.

51A. Effects of Dehydration and Adverse Conditions on Germination of Pathogenic Pythium spp. Amber Lancaster, Jessy Anders, Josh Garst, Osvaldo Arroyo, Zachary Foster, Chance McCune, LaShall Bates, Gary Bates. *Biology, NWACC, Bentonville, AR 72712*.

Pythium spp. cause damping off and root rot in a wide variety of plants. Plants grown in hydroponic situations are particularly susceptible to this pathogen as it is ubiquitous in moist environments. This disease can be particularly devastating in hydroponic situations. Methods to control the disease include strict sanitation and monitoring to keep the system in a highly productive mode. Once a Pythium infestation occurs, it will reoccur unless the entire system is dismantled and disinfected. This study focused on testing the ability of the pathogen to survive in artificial environments. Pythium aphanidermatum was grown in native soil, potting soils, and aqueous environments. These environments were subjected to harsh environmental conditions then check over a time course to test presence and viability of oospores. The samples were tested for germinability and the ability to return to a metabolically active status.

51B. Web Tool Supporting the Development of a Natural Product-Drug Interaction Terminology. Daniel Blankson, *Computer Science, Philander Smith College, Little Rock, AR 72202;* Joseph Utecht, Jonathan Bona, John Judkins, Mathias Brochhausen, *Bioinformatics, UAMS, Little Rock, AR 72205.*

Background: Using natural products and prescribed medications simultaneously is of grave concern due to insufficient knowledge on its interactions. A Center of Excellence for Natural Product Drug Interaction Research was established in 2015 to ascertain the clinical relevance of pharmacokinetic interactions between natural products and prescribed drugs. This Center has created an open-access repository where data is formally represented by sets of classes, attributes and relationships among class members. These relationships are formally represented using Web Ontology Language (OWL) to allow for better comparability between studies. In providing an OWL file representing the domain, we need to enable potential re-use of classes, object and data properties. However, this gets problematic since multiple large ontologies need to be searched for existing terms related to Natural Product Drug Interactions, which has proven to be extremely laborious using th e currently available tools such Onto Bee.
Method: We retrieved ontologies from multiple websites, built a custom graph database to store data called a triple store, and loaded these ontologies into the triple store. We then built a searching framework to quickly retrieve information from the triple store.
Results: In this poster, we report the setting up of triple store that was populated with the following ontologies: Drug Ontology (DRON), Gene Ontology (GO), Protein Ontology (PRO), and Chemical Entities of Biomedical Interest (CHEBI). A web-based search tool to allow users to search for class names, labels, definitions, and comments in an accelerated and streamlined manner was programmed.

52A. Theory of Epidemics: Epidemic Models. Makayla Cowles, Veronica Parker, Anna Harris. *Mathematics and Computer Science, UA Pine Bluff, Pine Bluff, AR 71601.*

Epidemic models are derived from tedious studies of math and epidemiology. Mathematical models are used in determining the future of an epidemic, controlling an epidemic, and reducing the risk of an epidemic. The two simplest models are the S.I.R. and the S.I.S. model. S.I.R. stands for susceptible, infective, and removal, while S.I.S. stands for susceptible, infective, susceptible. Differential equations have been derived to describe these two models and determine the outcome of the epidemic. These models are commonly used as building blocks for complex diseases with added populations or conditions.

52B. Poster withdrawn.

53A. Prevalence of Antibiotic Resistant Strains of Enterococcus spp. and Acinetobacter spp. In Community Household Environment. Rebekah Elliott, Jada Caplinger, Anuradha Ghosh. *Biology, Pittsburg State University, Pittsburg, KS 66762.*

With increasing prevalence of antibiotic resistance threats, there is an upsurge in the occurrence of community-acquired infections. The purpose of this study is to assess the ecology and prevalence of Enterococcus spp. and Acinetobacter spp. (that are well-known antibiotic resistant nosocomial pathogens) in the household environment. Each household sampling kit contained 5 swabs for each of shoe bottom, restroom, cleaning supply, kitchen top, and door step/handle as well as a demographic data sheet to be filled up. A total of 30 such kits (n=150) have been processed. The swabs were subjected to enrichment using selective media for test bacterial species. Total number kits positive for growth of suspected enterococci and Acinetobacter spp. were determined. Only few cleaning supplies showed growth for enterococci whereas the kitchen top showed more frequent enterococcal contamination. Although majority of the locations swabbed were contaminated with suspected Acinetobacter spp., door step/handles were free of any selected microbe. Overall, most of the swabbed locations were contaminated with biochemically confirmed Acinetobacter spp. in contrast to fewer with enterococci. A panel of antibiotics were tested for their susceptibility. Further PCR amplification of selective genes will be carried out to confirm at the species level. The antibiotic-resistant isolates will be genotyped and compared to their relative nosocomial strains. The community will be outreached with recommended cleaning protocol and stewardship in antibiotic consumption and resistance. The outcome of this study may help facilitate effective and appropriate antibiotic treatment of community-acquired infections.

53B. An Investigation in Translesion Polymerase Activity on G-Quadruplex DNA. Lane Smith, Robert Eoff, Amit Ketkar. *Chemistry, Southern Arkansas University, Magnolia, AR 71753; Biochemistry and Molecular Biology, UAMS, Little Rock, AR 72204.*

G-quadruplex (G4) DNA is a four-stranded helical structure composed of guanine repeats and can act as an endogenous barrier to DNA replication, disrupting cellular homeostasis. Specialized translesion DNA synthesis proteins and enzymes are required to ensure fork progression, and deficiencies of these components result in increased DNA damage. The explicit role of translesion polymerases during G4 replication has yet to be identified, however. The Eoff lab previously performed a kinetics study of hpol η (a Y-family TLS pol) and hpol ε (a B-family pol) near G4 DNA and observed an increase in hpol η activity and decrease in hpol ε activity two nucleotides prior the G4 motif. Additionally, hpol η displayed higher accuracy at the G4 site than hpol ε. These patterns suggest that TLS pols may suppress mutagenesis at G4 sites. To test our hypothesis, we utilized a SupF forward mutation assay to investigate mutation frequencies and profiles associated with G4 replication in ηKO and Rev1KO Hap1 cell lines. The presence of a G4 motif upstream the target gene resulted in a 200-fold and 250-fold increase in mutation frequency in ηKO and Rev1KO cells. When a G4 stabilizing molecule was added, a 500-fold and 700-fold increase was observed.

54A. Does BMP signaling respond to changes in membrane voltage? Lane Smith, Mikolaj J. Sulkowski. *Chemistry, Southern Arkansas University, Magnolia, AR 71753.*

Bone morphogenic protein (BMP) signaling plays crucial roles in synaptic growth and homeostasis. The correlation between synaptic activity and development is an area of growing interest in research. A previous study identified a novel noncanonical BMP pathway characterized by pMad accumulation at the synaptic termini. Interestingly, this form of BMP signaling depends on the activity of ionotropic glutamate receptors (iGluRs). These findings suggest that BMP signaling may be an acute sensor of synapse activity. To test our hypothesis, we utilized Drosophila lines bearing a hormone-responsive (RU486) and tissue-specific Gal4 native gene promoter. Muscle-specific (MHC-GS) and neuron-specific (Elav-GS) drivers were crossed with UAS-ion channel target genes (Kir2.1, EKO, and eagDN). By selectively exposing first and second instar larvae to RU486 in food medium, dynamic changes in membrane voltage were achieved. pMad levels in NMJ synapses and motor neurons were analyzed via immunofluorescent microscopy. Analysis revealed that synaptic pMad levels displayed significant changes in response to alterations of membrane voltage.

54B. Cloning and Expression of Human Separase. Valeria Robleto, *Biology, University of the Ozarks, Clarksville, AR 72830;* Pati Debanada, *Department of Pediatrics, Texas Children's Hospital, Baylor College of Medicine, Baylor, TX.*

Separase (ESPL1) is a protease that cleaves the cohesin complex during the start of anaphase facilitating the separation of sister chromatids. When overexpressed, Separase induces aneuploidy and tumorigenesis, and it has been reported as an oncogene in a variety of cancers. Because of its importance for the cell cycle, it is highly regulated. The protein Securin acts as a chaperone helping to fold ESPL1 as well as inhibiting early activation. In order to continue our understanding of the structure and domains responsible for the

expression of human Separase, this study will focus on co-expression of Human Separase with different domains of its inhibitory chaperone, Securin. The ORF of human Securin and various mutants of Securin were utilized to co-transfect mammalian cells along a plasmid encoding for WT Separase. After transfection, the yields of Separase significantly increased when bound to the Securin mutants when compared to a transfection of Separase alone. I was able to successfully express what should be an active and folded hSeparase.

55A. Metagenomic Analysis of Microbial Communities in Blanchard Springs Caverns, Arkansas and an Investigation of Low Temperature Tolerance in Cave-adapted Invertebrates. Monica Brooke Johnson, Caitlyn Bosch, Brooke Jones, Quincy Gragg, James Engman. *Biology, Henderson State University, Arkadelphia, AR 71999.*

Metagenomic Analysis of Microbial Communities in Blanchard Springs Caverns, Arkansas and an Investigation of Low Temperature Tolerance in Cave-adapted Invertebrates. Authors: Monica Brooke Johnson, Caitlyn Gosch, Brooke Jones, Quincy Gragg and James Engman, PhD. (mentor) Cave communities provide examples of organisms adapted to extreme environments. The unique adaptations of extremophiles make them excellent candidates for sources of novel biological compounds. We use molecular genetic techniques to survey the bacterial flora of Blanchard Springs Caverns, Arkansas, the most biologically diverse cave in the Ozark Plateau. Recent work concentrates on the flora of the cricket Ceuthophilus gracilipes. Cricket biomass constitutes a significant portion of available energy in the cave, making them a pivotal species in that ecosystem. No previous work on cave cricket microbes has been published. We examined the bacteria of the exoskeletal surface and the digestive system. Our initial techniques depended on culturing bacteria in the lab and sequencing the DNA of colonies that grew. Recently, we have used metagenomic sequencing, eliminating the need for culturing. This has increased our bacterial species identified from 9 species to over 200. We have also identified bacterial species from a store-bought cricket, giving us a control group, allowing us to identify which bacterial species are unique to cave crickets. Our observations revealed that crickets from Blanchard Caverns have an unexpected tolerance to temperatures approaching freezing. This tolerance seems at odds with the fact that the crickets live in an environment that is highly thermally stable, remaining constant at 12 C (54 F) throughout the year. Little is known about thermal tolerance in cave-adapted organisms, but the few studies published suggest that tolerance to temperature change is generally much less than in surface dwelling organisms (Mermillod-Blondin et al. 2013; Rizzo et al. 2015). A preliminary experiment suggests that cave crickets remain active for at least 18 hours at temperatures of 0 C, while commercially obtained gray crickets rapidly become inactive. Many of these have unique adaptations, and provide insight into the energetics and complexity of systems that have traditionally been considered very simple. Some bacteria from our samples have DNA sequences distinct enough to be considered new species.

55B. Alterations in Hemodynamic Loading leads to Some Morphological Changes of the Heart in Developing Mouse Embryos. Tanner Hoog, Samantha J. Fredrickson, Ryan S. Udan. *Biology, Missouri State University, Springfield, MO 65897.*

Congenital heart defects are aberrations to normal heart development that can have very serious implications in the health of children. Emerging studies indicate that the mechanical force created by the flow of blood (also called hemodynamic loading) can play a role in proper heart development. For example, previous experiments on zebrafish and chick embryo models indicate that altered blood flow impairs heart morphogenesis on a physiological and cellular level, but little is known about how flow affects mammalian heart development. Utilizing hemodynamic manipulation techniques previously found to work in mouse embryos, we sought to assess how alterations in mechanical force affected mammalian heart development. Using OPT microscopy we assessed structural changes of the heart, specifically looking at volume, myocardial thickness, trabeculation, and the extent of heart looping. We hoped that elucidating the structural and cellular responses to altered force would provide new insight into how congenital heart defects arise in mammals and provide guidance for establishing ways to correct this disease is humans. Our studies have found a correlation with hemodynamics and increased myocardial thickness, but have failed to show looping and trabeculation structural defects that have previously been described in chick and zebrafish studies.

Chemistry and Biochemistry

Friday Oral Platform Session

ORAL – 3:20. **Medium Throughput Extraction of Nanocellulose from Cellulose.** Jason C. Lam, Benjamin A. Babst, Angele Djioleu, Amanda M. Foust, William L. Headlee. *School of Forestry and Natural Resources, UA Monticello, Monticello, AR 71655.*

There is potential for developing novel products from woody biomass based on cellulose nanocrystals (CNCs), which are environmentally friendly and have high mechanical strength, thermal stability, and surface functionality. With the potential for rapidly developing markets for CNCs, we are developing methods to extract and characterize CNCs from different wood species from trees available in Arkansas. From the four different species tested, we observed properties that are conducive to efficient and high yielding cellulose extraction (i.e. high specific gravity and cellulose content, low lignin content). Using a mechanical and chemical based platform, we have successfully extracted cellulose pulp from the species and produced CNCs on a micro-scale for medium throughput analysis. The resulting CNCs presented great thermal stability, maintained the original cellulose crystalline form, and had average lengths ranging from 140nm to 400nm. Future work will use the developed methods to assess the impacts of feedstock quality on cellulose-based nanomaterials that can be derived from southern forest trees.

ORAL – 3:35. Synthesis of Functionalized Nanocages for Engineering Nanoscale Stem Cell Scaffolds. Alison Luscomb, *Chemistry, UA Fort Smith, Fort Smith, AR 72904;* Jingyi Chen*, Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

Stem cells are precursor cells which are significant in their ability to transform into a multitude of mature cell types. The potential for stem cells is impactful in the growth of new tissues or the recovery of damaged tissues. Three dimensional patterned surfaces create a more native cellular environment and may be utilized to guide the differentiation of stem cells. In this research, the nanostructures used are hollow, cubic gold nanocages that act as a nanoscale scaffold for cell growth. Gold nanocages were selected for this research for their biocompatibility as well as ability for bioconjugation through gold-thiolate chemistry. The gold nanocages were synthesized via galvanic replacement reaction of solid silver nanocubes. This reaction was monitored by UV/vis spectroscopy for an extinction peak at approximately 750 nm. The gold nanocages were further characterized and analyzed by transmission electron microscopy. The gold nanocages were found to have an edge length of roughly 34 nm. After synthesis of the gold nanocages, they were attached to glass substrates via bifunctional polyethylene glycol (PEG) with both thiol and carboxyl termini. Conjugation of the nanocages with PEG was confirmed through changes in zeta potential and hydrodynamic diameter. Attachment to glass was evaluated visually for the presence of nanocages. The successfully conjugated cages were sent to UAMS to examine stem cell viability on the scaffold.

ORAL – 3:50. Design of an Open-Source Stopped-Flow Absorption Spectrometer. William R. Hayes, William A. Gunderson. *Chemistry, Hendrix College, Conway, AR 72032.*

Two primary components of a stopped-flow absorption spectrometer (SFAS), a syringe driver and a visible absorption spectrometer, have been constructed using an Arduino Uno microcontroller, 3D printed materials, and open-source design principles. A SFAS is a laboratory instrument which allows for determination of enzymatic and chemical kinetic rates of a given reaction at the millisecond to second time scale. The use of open-source designs and inexpensive materials have allowed for the production of the components for the SFAS at a cost lower than that of commercial components. The syringe driver shows a consistent linear correlation between the number of stepper motor rotations and the mass of water pumped out of the syringe, demonstrating that this syringe pump can be used as a reliable delivery mechanism for the SFAS. The visible absorption spectrometer shows an absorption curve for bromothymol blue that correlates closely with data collected from commercial spectrometer. The two components described here will be combined in the construction of a completed SFAS.

ORAL – 4:05. Design, Synthesis, and Affinity of Dopaminergic Derivatives in SULT1A3. C. Skyler Cochrane, Diana J. Bigler, Mauricio Cafiero, Larryn W. Peterson. *Chemistry, Rhodes College, Memphis, TN 38112.*

Sulfation is an essential pathway through which endogenous catecholamines and xenobiotic substances are metabolized and can be inactivated and/or have their solubility increased to sometimes facilitate removal from the body. The sulfotransferases (SULTs) catalyze the transfer of a sulfuryl group from 3´-phosphoadenosine-5´-phosphosulfate (PAPS) to various substrate molecules. SULT1A3 is of interest due to its role in the body and its specific substrate affinity for catecholamines, such as dopamine. The factors governing SULT1A3's substrate selectivity are not well known, although research has shown 4 amino acids, His108, Lys, etc., which are believed to be the major

contributors to substrate binding. Of those 4, His108 is believed to be the most critical as it facilitates the deprotonation of the hydroxyl group of the substrate molecule and allows the sulfuryl transfer to take place. In order to test this hypothesis, a library of novel dopaminergic derivatives that all have either an electron donating or withdrawing group located at the 6 position were designed. These modulations should impact the affinities of the compounds to bind within the active site and/or the magnitude of the electron donating/withdrawing character of the substituent will either aid or decrease the rate of deprotonation. These effects have been tested both computationally via ab initio modeling and experimentally in a HPLC-based SULT1A3 enzymatic assay. The complete narrative from design to synthesis to biological evaluation will be discussed.

ORAL – 4:20. Identifying the Structure of Fat Mobilizing Substance (FMS-1) Associated with Congenital Lipodystrophy. Mallory Bryant, Dennis Province. *Chemistry, Harding University, Searcy, AR 72143.*

A fat mobilizing substance is present in the urine of fasting individuals. It is believed that the same fat mobilizing substance is found in the urine of people who suffer from congenital lipodystrophy. A sample of urine from an individual with congenital lipodystrophy was obtained and purified. It was separated into fractions using size exclusion chromatography, and fat-mobilizing activity was detected using an adipocyte lipolysis assay kit. The results were compared with the results of samples obtained from healthy college-aged individuals under well-fed and fasting conditions. The purification protocol was repeated using samples from men over the age of forty with a BMI classified as obese under well-fed and fasting conditions. For future research, the samples will be purified using a Human-6 column to remove the 6 most abundant proteins found in serum, and the samples will be analyzed for fat-mobilizing activity.

ORAL – 4:35. Effect of Novel Compounds on Hydrogen Peroxide-Induced Cataract Formation in Cultured Bovine Lenses. Taylor Hammonds, *Biology, UA Pine Bluff, Pine Bluff, AR 71601;* Segewkal Heruye, Jia Sun, Catherine A. Opere. *Pharmacy Science, Creighton University, Omaha, NE 68178.*

Problem: Cataracts are gradual opacification of the lens leading to visual impairment and blindness. Although a large population is affected, there are no pharmacological treatments available for cataracts. Surgical approach is still the mainstay of therapy. As a result, pharmacological treatments for cataracts may play important role where surgery is limited. Oxidative stress is implicated in cataracts of mammalian eyes and hydrogen peroxide (H_2O_2) content was higher in aqueous humor and lenses of cataract patients. Furthermore, in-vitro H_2O_2 insults on lenses and human cataracts share a similar pattern of damage. The gaseous signaling molecule, hydrogen sulfide (H_2S) has neuroprotective effects in CNS disorder models due to its antioxidant, anti-inflammatory & anti-apoptotic properties5. However, its role on cataract formation is not completely explained. Therefore, we hypothesize that a H_2S donor, Drug A, will prevent cataracts and maintain the integrity of lenses. Thus, in this study Hydrogen Peroxide insult will be used to induce cataracts in cultured bovine lenses.
Aim: (1) Evaluate the effect of Drug A on Hydrogen-Peroxide induced cataract formation.
Method: Aim (1) - Concentration and time dependent studies were conducted to determine optimal concentration of H_2O_2 insult that induces cataracts in bovine lenses. Lens opacity will be determined using a plate reader (Synergy H1 hybrid reader; Bio Tek Instruments, Inc) measuring transmittance (230 nm to 710 nm). Lenses were cultured in DMEM buffer solutions as follow: Group 1: Control (DMEM); Group 2: 50mM of H_2O_2 based dose response curve; Group 3: Positive control (Ascorbic acid 10mM); Group 4-7: Experimental groups (Drug A at 10-3, 10-4, 10-5, 10-6 M concentrations); Group 8-11: Experimental groups (H_2O_2 + Drug A at 10-3, 10-4, 10-5, 10-6 M concentrations). Pictures of well plates were taken against a grid to visually inspect formation of cataracts.

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5. Chen, W. L., Niu, Y. Y., Jiang, W. Z., Tang, H. L., Zhang, C., Xia, Q. M., Tang, X. Q. (2015). Neuroprotective effects of hydrogen sulfide and the underlying signaling pathways. Rev Neurosci, 26(2):129-42.

Chemistry/Biochemistry
A – Saturday 8:00 – 9:00 Posters
B – Saturday 9:15 – 10:15 Posters

(Posters designated "U" will be judged.)

101A. Synthesis and Relaxivity of Target-Specific MRI Contrast Agents. Callie Clement, Joe Bradshaw. *Chemistry, Ouachita Baptist University, Arkadelphia, AR 71998.*

Magnetic resonance imaging (MRI) is an important test in the medical field that provides a painless, noninvasive way to visualize images of the body by using a strong magnetic field. Contrast agents have provided many benefits to MRI imaging. An effective contrast agent has high specificity, high relaxivity, is soluble in water, and is thermodynamically stable. MRI usually depends on contrast agents to show abnormalities because the relaxivity rates of diseased tissue are quite different than the relaxivity rates of normal tissues. Relaxivity refers to the time required for protons to return to their equilibrium state in the longitudinal direction of the applied magnetic field after excitation by a pulse. There are numerous contrast agents being used today that significantly improve MRI imaging. However, a contrast agent that is organ specific would be even more advantageous for diagnosing diseased tissue and monitoring this tissue throughout treatment. The goal of this research was to produce a contrast agent that has organ specificity. This research involves the synthesis, purification, and measuring the relaxation rates for a gadolinium-based contrast media, as well as testing contrast agents already being used. Products were tested using T1 relaxation rates to compare the newly developed agents which were synthesized using glucuronamide and 2-methoxyphenylpiperazine to current contrast agents being used today.

101B. Treating Breast Cancer with Light: The Creation of a Photodynamic Therapy Agent. Victoria Lackey, Joe Bradshaw. *Chemistry, Ouachita Baptist University, Arkadelphia, AR 71998.*

Photodynamic therapy (PDT) is a treatment for a wide range of disorders, including cancer. The PDT procedure requires the usage of photosynthesizing agents, which are activated in the presence of light. One successful PDT agent is porphyrin derivative. This research focused on producing the water-soluble porphyrin, H2TPP-PEG-3-OH, through the attachment of the porphyrin, H2TPPC, with amino-PEG-3-alcohol. The novel, water-soluble PDT agent was purified and then characterized by nuclear magnetic resonance spectroscopy (NMR) and UV-vis spectroscopy. Additionally, the purity was confirmed through high performance liquid chromatography (HPLC). To determine the cytotoxicity level of the novel PDT porphyrin, H2TPP-PEG-3-OH, the agent was conditionally tested by the presence and absence of light, using MTT assay on MDA-MB-231 triple negative breast cancer cells.

102A. DFT Study of the Selectivity of Monoamine Oxidase B (MAOB). Audrey Woody, Samantha Jelinek, Larryn W. Peterson, Muaricio Cafiero. *Chemistry, Rhodes College, Memphis, TN 38112.*

MAOB is an enzyme located on the outer mitochondria that is responsible for degrading penylethylamine, benzylamine, and dopamine. MAOB inhibitors are generally used as a treatment for Parkinson's disease, because they stop the breakdown of dopamine. By selectively designing an inhibitor for the MAOB enzyme, the breakdown of dopamine can be reduced, thus leading to an increase of the neurotransmitter. A suite of dopaminergic derivatives have been developed as potential inhibitors of the MAOB enzyme. The inhibitory effectiveness of these dopaminergic derivatives has been measured via silico models in which the strength of interaction between each substrate and the enzymatic active site were analyzed. A crystal-structure of the MAOB active site, docked with the widely employed diabetes drug pioglitazone, was isolated from the Protein Data Bank (PDB ID: 4A79). The positions of novel dopaminergic derivatives were optimized in the active site using M062X/6-31G with implicit solvation and with flexible amino acid side-chains. Interaction energies between the ligands and the protein were calculated using M062X and MP2 with the 6- 311+G* basis set. 6-aminodopamine appears to be the strongest inhibitor of the MAOB enzyme, surpassing dopamine.

102B. DFT analysis of water clusters, dopaminergic derivatives, and their desolvation energies. Emily Sanders, Mallory Morris, Larryn Peterson, Mauricio Cafiero. *Chemistry, Rhodes College, Memphis, TN 38112.*

Our current research explores the synthesis, metabolism, and excretion of novel catecholamines which could serve as drugs in the dopaminergic pathway. By studying all of the enzymes involved in the dopaminergic pathway, we can paint a comprehensive picture of how these catecholamines will behave in our bodies which will help us find novel drugs that could treat conditions such as Parkinson's disease. Computational models of dopaminergic analogs were used to examine the substratesâ€™ binding in the enzymatic active site. The binding of a ligand to an enzyme not only involves the interaction between the ligand and the enzyme but also the energy lost or gained by desolvation of the ligand. Desolvation of dopaminergic derivatives was examined using a series of hydration shells that increase in size. The desolvation energies were calculated using M062X with the aug-cc-

pvdz, cc-pvdz, and cc-pvtz basis sets. Ligands with amine group in the sixth positon of the ring exhibited the least favorable energies, whereas neutral ligands exhibited the most favorable desolvation energies in the explicit water model. The implicit Polarizable Continuum Model was also used together with explicit solvation to calculate desolvation energies of dopaminergic ligands. The use of implicit and explicit models was compared. This information will be combined with prior research done on ligand/enzyme interaction in order to get a more comprehensive understanding of ligand binding in this system.

103A. Comparative Analysis of Fat Mobilizing Substance and Lipolytic Proteins in Lipodystrophy Patients and Fasting Humans. Alexandra Adeoye, Cindy White, Dennis Province. *Chemistry, Harding University, Searcy, AR 72143.*

It has been discovered that a Fat Mobilizing Substance (FMS) can be isolated from the urine of fasting individuals. It is believed that FMS can also be isolated from individuals with congenital lipodystrophy. Previous research has shown that FMS activity is absent within hypophysectomized individuals promoting the assumption that the pituitary gland is responsible for this activity. Well fed, fasting and lipodystrophy urine samples were obtained, purified and isolated. These samples were separated and analyzed using high-pressure liquid chromatography. The resulting chromatograms were compared to a molecular weight ladder and to hormones found in the pituitary linked with lipolytic activities to identify isolated substances. These samples were also analyzed by gel electrophoresis.

103B. Quantification of Brominated Vegetable Oil by LCMS. Katelynn Farmer, Dennis Province. *Chemistry, Harding University, Searcy, AR 72143.*

Brominated vegetable oil (BVO) is used in the United States as an emulsifier in citrus-flavored soft drinks to prevent phase separation during distribution. The possibility of reaching high levels of bromine concentration in the body by excessive consumption of citrus-flavored soft drinks lead the European Union to ban BVO as a food additive. The Food and Drug Administration in the United States imposed a mandatory limit of 15 ppm in all soft drinks to limit the public's consumption. In the past, popular methods of quantification required derivatization and an extensive sample preparation process, but quantification by liquid chromatography mass spectrometry (LCMS) allows for a direct approach. The quantification by electrospray ionization mass spectrometry allows for the monitoring of specific ions of interest and a single point standard addition procedure. This method was applied to several soft drink samples that were found to contain BVO levels under the FDA mandated 15 ppm limit of BVO in citrus-flavored drinks.

104A. Gramicidin Subunits that Cross Membranes to Form Channels. Matthew Brownd, *Chemistry, John Brown University, Siloam Springs, AR 72761;* Matt McKay, Fahmida Afrose, Denise Greathouse, Roger Koeppe II, *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

Gramicidin A (seq: formyl-L-Val-Gly-L-Ala-D-Leu-L-Ala-D-Val-L-Val-D-Val-L-Trp9-D-Leu-L-Trp11-D-Leu-L-Trp13-D-Leu-L-Trp15-ethanolamine) is a membrane-based peptide that is able to function as a selective ion channel for monovalent cations. Each channel is a dimer, consisting of two gramicidin subunits which are held together by hydrogen bonding. Due to the affinity of Trp for the membrane/water interface, these subunits are anchored by the four Trp residues, preventing them from crossing the membrane, and requiring that gramicidin be introduced to both sides of the bilayer in order to facilitate channel formation. However, it has been observed that replacing Trp residues 13 and 15 with Phe results in subunits (designated [Phe13,15]gA) which are capable of crossing the membrane in a double-stranded conformation and engaging in channel formation, although these channels are too short to be effectively used in true cell membranes. Based on this finding, we have chosen to investigate the 17-residue peptide endo-Gly0A-Gly0B-[Phe13,15]gA, which we believe will maintain the ability to cross the cell membrane and form ion channels, in addition to allowing for more stable channels in thicker membranes. To contribute to this hypothesis, I synthesized both [Phe13,15]gA and endo-Gly0A-Gly0B-[Phe13,15]gA, and performed a preliminary comparison of the confirmations of the respective subunits. The investigation was primarily conducted using deuterium NMR, made possible by incorporating deuterated alanines at the 3rd and 5th positions of both peptides, together with circular dichroism spectroscopy and tryptophan fluorescence. It was concluded that both peptides exhibit singular, slightly different major conformations which closely resemble those of the single-stranded channel conformation of unmodified gA.

014B. Exploring the Additivity of Urea and Anion Interactions. Jaydee Edwards, Jill Ellenbarger. *Chemistry, John Brown University, Siloam Springs, AR 72761.*

Water is essential to life. Unfortunately, 10% of people in the world do not have access to clean water because of the difficulties in purification. Often, chemical contaminants can cause long-term health effects, specifically, anions such as fluoride, nitrite, etc. In order to develop better sensors of target anions, hydrogen-bonding interactions were explored between these

anions and urea, an organic compound. This study began with a series of benchmark testing through Gaussian 03. The testing found functional group B3LYP and basis set TZVP to yield precise interaction energies in a time efficient manner for this select group of anions and urea. Next, a series of bis-urea compounds in a bipodal structure connected by an organic bridge was tested to determine the interaction energies of the compound with each target anion. The bipodal structures were broken down into three fragments. The sum of the interaction energies of each fragment per anion was shown to add up to the interaction energy of that anion with the total compound.

105A. Extraction and Quantitation of Heterocyclic Aromatic Amines from Cooked Bacon using Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectroscopy. Emily Seminara, *Chemistry, Hendrix College, Conway, AR 72032;* Lora J. Rogers, Susan Kadlubar, Howard P. Hendrickson, *Pharmaceutical Science, UAMS, Little Rock, AR 72205.*

Diabetes affects 11.7% of inhabitants within the â€œdiabetes beltâ€ of the southern United States, and type 2 diabetes (T2D) makes up around 90-95% of all of these cases of diabetes. T2D can be managed by healthy eating, physical activity, and medications. However, though we are aware that diet plays a part in greater risk of T2D, there is not yet a mechanistic explanation as to why this occurs beyond controlling the intake of carbohydrates which are converted to glucose. One source of this increased risk may be in the trademark southern diet, rich with fried meats and gravy. Heterocyclic aromatic amines (HCAs) are compounds found in meats cooked at high temperatures, such as those characteristic of the southern diet. HCAs are known as carcinogens, but recently 2-Amino-1-methyl-6-phenylimiazo[4,5-b]pyridine (PhIP), one of the most abundant HCAs, was found to upregulate 20 genes involved in heightened risk of T2D, notably Collagen VIII alpha-1 polypeptide (COL8A1) and Insulin-like growth factor binding protein 7 (IGFBP7). To observe the effects of HCAs extracted from meats typical of the southern diet on these genes, HCAs were extracted from cooked bacon using solid phase extraction (SPE). The HCAs PhIP, MeIQx, and AÎ±C were analyzed using liquid chromatography/tandem mass spectrometry (LC-MS/MS). While other HCAs are likely present, the current work detected predominately PhIP and MeIQx in the cooked bacon. Human mesenchymal stem cell (hMSC)-derived adipocytes are being exposed to dilutions of the HCA extracts and expression of genes associated with T2D will be determined.

105B. Synthesis of Secondary Arylamines Through Oxidation Reaction of Alboronic Acids. Fernanda Hernandez Sanchez, *Chemistry University of the Ozarks, Clarksville, AR 72830;* Claudia Contreras, *Biological and Chemical Research Institute, Universty of Michoacan of San Nicolas de Hidalgo (Morelia, Mexico).*

Heterocyclic compounds are an abundant topic in organic chemistry, and most of the organic compounds correspond to this group. In this experiment, we want to achieve the synthesis of secondary aryl amines, which have a very important role in the pharmaceutical industry, for example the diazepine. We performed several trials in which we change either one of the reactants (which refer to the arylboronic acids), the solvent, or the conditions of reaction, keeping the catalyst and the solvent as constants. Among the reactants we used are derivatives of naphtalenes, benzopirones, and α amino acids. Also, the different conditions were either reflux at a variety of temperature, or simply room temperature; both conditions always accompanied of stirring. The solvent used was ethanol, and the catalyzer was cupper acetate, which is a compound in this reaction due to the oxidation of the reactants that we want to achieve in order to obtain a secondary arylamine. Our results showed that at room temperature, a best product is obtained.

106A. Analyzing composition of plaster and soil samples from Tel Beth-Shemesh archaeological site. Peyton Munch, Dale Manor, Dennis Province. *Chemistry, Harding University, Searcy, AR 72143.*

A plaster sample from Tel Beth-Shemesh, an archaeological site in Israel, was analyzed to test whether the plaster is hydraulic. Hydraulic lime plaster contains the addition of calcium hydroxide and calcium carbonate, which improves its final strength. It sets much faster that air plaster and was a technological construction advancement in the ancient world. This sample is from a strata that is from ~ 900 BC. Carbonate content is a measure of how hydraulic the plaster is. Concentrated acid was added to plaster samples to convert calcium carbonate to carbon dioxide. This gas was then bubbled through a solution with phenol red indicator and the pH change was measured spectroscopically and using a pH meter. Hydraulic plaster contains higher levels of carbonates, however to an unknown extent. To counter this, natural hydraulic plaster samples were compared to plaster standards. A soil sample obtained from Tel Bethsemeth was analyzed to provide evidence for or against the presence of a stable in the area where the sample was collected. This was done by testing for P2O5, a known component of urine. The phosphate concentration in soil will be determined by a spectrophotometric method, first by extraction with an HCl/NH4F solution, then by a reaction with sulfuric acid, ascorbic acid, ammonium molybdate, and potassium antimonyl tartrate. The resulting solutions was measured at 800 nm.

106B. Synthesis and characterization of a novel Zn(II) porphyrin incorporating TAMRA for use as a PDT agent. Savanna Harris, Joseph Bradshaw. *Chemistry, Ouachita Baptist University, Arkadelphia, AR 71998.*

Photodynamic therapy (PDT) agents have utilized porphyrin derivates but a need has arisen for the synthesis of 'second-generation' photosynthesizers. It is important that the 'second-generation' PDT agents show absorption in the red region of the visible spectrum and lack toxicity in the dark. It is necessary for the PDT agents to show absorption in the red region of the visible spectrum because of the scattering and absorption effects, where the transmission of visible light through tissue is very low at 400 nm (the maximum absorbance for porphyrins is ca. 415 nm), and reaches a maximum in the 700-800 nm region. In this research, a Zn(II) porphyrin, 5,10,15,20-tetra(4-ethynylphenyl) porphyrinatozinc(II), was synthesized with the purpose of utilizing 'click' chemistry to attach the porphyrin to the photo-enhancing group TAMRA (tetramethylrhodamine) azide. UV-vis spectroscopy and fluorescence spectroscopy were utiliz ed to characterize the novel bio-conjugate porphyrin, Zn(TPPTAM). Additionally, TLC prepatory plates were utilized to purify the final product. The substitution on the porphyrin periphery was modified to increase the absorption in the red region of the visible spectrum. Due to this modification, this bio-conjugate prophyrin has a greater potential use as a 'second-generation' PDT agent.

107A. Development of a New Water-Soluble Photodynamic Therapy Agent for treatment of Breast Cancer. Sally Owens, Joseph Bradshaw. *Chemistry, Ouachita Baptist University, Arkadelphia, AR 71998.*

Photodynamic therapy is a method of treatment involving the use of photosensitizing agents, drugs that are activated by light, to treat various diseases including cancer. One type of photosensitizer is that of porphyrin; a class of organic molecules composed of heterocyclic macrocycle organic compounds, composed of four modified pyrrole subunits interconnected at their α carbon atoms via methine bridges and incorporating various substituents. In this project, the 4-piperidinemethanol group was added to a porphyrin core, H2TPPC, to create the novel water-soluble porphyrin, H2TPP-PMeOH. The compound was then purified using liquid chromatography and structurally characterized by using infrared spectroscopy (IR), nuclear magnetic resonance spectroscopy (NMR), and UV-vis spectroscopy. Finally, the cytotoxicity of H2TPP-PMeOH was determined with and without exposure of white light using MTT assay on MDA-MB-231 triple negative breast cancer cells.

108A. A Drug Repositioning and Diversification Strategy for Discovery of Compounds with Anti-Cancer Activity. Daniel Gibson, Matthew Chapa, T. David Bateman. *Chemistry, Henderson State University, Arkadelphia, AR 71999.*

Finding new uses for, and improving existing drugs offers greater likelihood of success in developing viable therapeutics while reducing the risk in investing in development. Our research is involved in developing simple analogs of the prescription drug Tramadol via a simple three-step synthesis that can easily be modified to produce a large number of compounds. These compound libraries will be screened for bioactivity through via a number of bioassays. The results of the initial screens will be used to improve the analog diversification strategy.

108B. Synthesis and analysis of tautomerically ambiguous cytosine based analogs to induce viral mutagenesis. Carlie Clem, Vincent K. Dunlap. *Chemistry, Henderson State University, Arkadelphia, AR 71999.*

Harmful viruses have posed a threat to the human race for generations. In particular, the human immunodeficiency virus (HIV) has been notably damaging to the individual and society alike. Although drugs to treat HIV exist, they are harsh and often result in negative side effects. The low fidelity replication enzymes that the virus replicates with contributes to the relative success of the virus' ability to evade antiviral medications, but can be exploited to develop new antiviral agents. This research focuses on viral mutagenesis, or the introduction of intentional errors in the genome of the virus. These resulting mutations will lead the DNA to reach error catastrophe and ablate. The method by which error will occur is the assimilation of synthesized cytosine based nucleosides with ambiguous hydrogen bonding faces resulting from tautomeric shift. These shifts will lead to the mispairing of DNA and a decrease in stability of the duplex molecule. Presented here are the details of the designed nucleosides' synthesis and spectroscopy, thermal stability of oligomers containing the nucleosides, and biological assays to demonstrate efficacy.

109A. DFT study of the selectivity of Mu-Opioid receptors. Erin Dempsey, Mauricio Cafiero. *Chemistry, Rhodes College, Memphis, TN 38112.*

Mu-Opioid receptors (MORs) are located in pain-sensing neurons and are a cause for the tolerance and hyperalgesia seen in extended opioid use, which can increase the risk of addiction and overdose. Methylnaltrexone (MNTX) is a drug that blocks MORs and is responsible for inhibiting the increase of opioid tolerance. MNTX only functions within the peripheral

nervous system due to its inability to cross the blood brain barrier, which allows the drug to inhibit tolerance build up while still allowing the analgesic properties of opioid drugs. When MNTX binds to MORs in the peripheral nervous system, it blocks the actions of opioids outside the central nervous system, where opioids have the most pain relieving effects. In this work, methylnaltrexone was inserted into the MOR active site where the ligand Beta-Funaltrexamine (B-FNA) naturally binds. The binding affinity between MNTX and the MOR active site were compared to the binding affinity of B-FNA in the same site, to see if the drug could effectively bind to the receptor. The ligands were optimized with implicit solvent with M062X/6-31G and relaxed amino acid side chains. Interaction energies between the ligands and protein were determined using M06L and MP2 with the 6- 311+G* basis set. The latest results will be discussed.

109B. Investigation of MoCl4(diimine) Anions and Related Compounds for Solvatochromism. Alison Chang, William Eckenhoff. *Chemistry, Rhodes College, Memphis, TN 38112.*

A solvatochromic compound is a chemical compound that changes its color based on solvent polarity. Various molybdenum anions with the form [Mo(N⌒N)Cl4]- and [Mo2(N⌒N,N⌒N)Cl8]2-, were found to possess solvatochromic behavior. [Li(12-crown-4)][Mo(bpy)Cl4] was found to be soluble in solvents ranging from water to acetone with an accompanying color change from yellow to blue. Similar colors were observed for the related [PPh4][Mo(bpy)Cl4] in the same solvents with the exception of water which it was not soluble in. The non-polar nature of its counter-cation extended its solubility to methylene chloride. When examined by UV-vis, the absorption of [Li(12-crown-4)][Mo(bpy)Cl4] shifted ~110nm across the visible region while [PPh4][Mo(bpy)Cl4] shifted ~70nm. X-ray crystal structures of both of these species show very little difference in the structure of their octahedral Mo anion and good agreement with previously known structures. A bimetallic molybdenum compound, [Li(12-crown-4)]2[Mo2(bppz)Cl8] (bppz=2,3-bis(2-pyridyl)pyrazine), was found to display solvatochromism red-shifted in respect to its monometallic counterpart, covering over ~140nm the visible region in the same solvents. However, another bimetallic compound [Li(12-crown-4)]2[Mo2(bpm)Cl8] (bpm=2,2-bipyrimidine) was more similar to [Mo(bpy)Cl4]- and displayed a similar color range and solvatochromic shift. Molecular calculations are currently underway to better understand this interesting effect.

110A. Math Anxiety and Cortisiol as a Biomarker. Colton W. Lechak, Brad A. Rowland, T. David Bateman. *Chemistry, Henderson State University, Arkadelphia, AR 71999.*

Generalized test anxiety and math anxiety are documented disorders that are especially prevalent amongst college students. College algebra has been proven to be the class most indicative of continued success in college, and by extension success in science, technology, engineering, and mathematic (STEM) career fields. The demand for STEM graduates is at an all-time high and is only continuing to increase, so it is necessary to both produce and retain STEM majors in their respective programs. The purpose of this study is to quantify math test anxiety in students enrolled in intermediate algebra courses and to formulate different coping, studying, and teaching methods in order to improve student performance and reduce stress levels in order to increase student persistence in STEM degree tracks. Many methods to alleviate student test anxiety have been proposed, but no studies exist that connect the proposed methods to their effectiveness as measured by biological assays. Such studies could serve as a monumental gauge of methods intended to assuage student math and test anxiety. From saliva collected from the students at chosen intervals, cortisol levels were measured and used as a stress biomarker through the implementation of an enzyme-linked immunosorbent assay (ELISA). Our initial analyses are indicative that cortisol levels are heightened after the subjects attend the intermediate algebra class, which does agree with the hypothesis initially postulated. Further study will need to be conducted in order to confirm the results initially derived, but early outcomes are promising.

110B. Ab initio and experimental determination of partition coefficients of drug-like molecules. Carter Embry, Larryn W. Peterson, Mauricio Cafiero. *Chemsistry, Rhodes College, Memphis, TN 38112.*

The lipophilicity of a compound is an important property for determining how effectively a drug or drug-like molecule can reach its intended target in the body. A drug's partition coefficient has a strong influence on absorption, distribution, metabolism, and excretion of the drug and thus is frequently used by medicinal chemists for assessment of drug-likeness in pre-clinical drug discovery. Traditional methods for determining the log of the partition coefficient, or log P, of compounds include the shake-flask method, or prediction using QSAR. The log P for various drug-like compounds were predicted by ab initio calculations of solvation energies using the M06-2X functional and 6-311+G* basis set, and confirmed experimentally by an HPLC-based shake-flask method.

111A. Calibration and Operation of a Mass Spectrometer to Measure Decomposition Gases for Propulsion Research. Calla Basset, Daniel Mckague, Jonathan Valenzuela, Norman Love. *Engineering*

Physics, Southern Arkansas University, Magnolia, AR 71753.

When studying rocket monopropellants, it's important to look at the gases that are formed as the propellant decomposes. This helps provide information on the effectiveness of the catalyst, expected temperatures of the exothermic reaction, and the presence of certain elements provide insight into how the vehicle may product thrust. For this project, a mass spectrometer is a device used to measure the composition of monopropellant decomposition gases by ionizing the particles and then sorting and measuring the particles by their mass-charge ratio. This process is used to identify the concentrations of different gases present. Calibration is necessary to ensure accurate results. The system used to calibrate the mass spectrometer includes flushing gas, a pressure regulator, exhaust valves and the input for the calibration gases. The mass spectrometer is calibrated using one tank with two gases of known concentrations and two tanks with four gases of known concentration. Once calibration tests provide satisfactory results, the mass spectrometer is used to measure the decomposition gases.

111B. Effect of simulated microgravity on radiation-induced endothelial dysfunction markers. Yassamine Ghazzali, Abdel Bachri, Rupak Pathak, Martin Hauer-Jensen. *Chemistry, Enginnering, and Physics, Southern Arkansas University, Magnolia, AR 71753.*

The effect of outer space radiation exposure and near-zero space gravity environment on DNA damage is not well documented, and is a primary concern to NASA in furthering its goal for deep space exploration. We illustrate technics of subjecting the cells to microgravity and discuss our preliminary findings on the role of microgravity. We irradiate Human Umbilical Vein Endothelial Cells (HUVECs), and subject them to ground-based simulated microgravity. HUVECs are used because cardiovascular diseases have been linked to genomic instability in endothelial cells. We use the High Aspect Ratio Vessel (HARV) bioreactor to seed the cells onto Cytodex-3 microcarrier beads and cause them to undergo free suspension, a condition similar to near zero gravity in the outer space. A key component for this experiment is to standardize the microcarrier bead concentration, cells attachment and the HARV rotation speed to achieve free suspension. This standardization is required in order to prevent damage to the cells during the long microgravity treatment and optimize cell recovery. We discuss standardization techniques to improve cell attachment and microgravity treatment. We share preliminary result that suggest microgravity. Simulated microgravity causes morphological alteration and enhances radiation-induced cell killing. Finally simulated microgravity alters the expression of radiation-induced endothelial dysfunction markers.

112A. Algae-Biotemplated Water-Splitting Copper Oxide Nanocatalysts for Hydrogen Production. Paloma Salazar, Sakr Elsaidi, Marina Avram, Daniel Nde, Wei Zhao. *Chemistry, UA Little Rock, Little Rock, AR 72204.*

Water-splitting hydrogen fuel production using carbon-free sources of energy, such as solar and wind energy, is a promising renewable and sustainable solution to solve the world problem of carbon pollution and global climate change associated with fossil fuels. The water-splitting reaction is composed of two half reactions, hydrogen evolution reaction (HER) and oxygen evolution reaction (OER). Low-cost, low over potential, and earth-abundant HER and OER catalysts are under intense investigation to enhance and speed up the reaction for practical applications on a large scale. One of the best strategies currently under development is using low-cost approaches to develop the catalysts at the nanoscale (<10 nm), and enhance their dispersion and electrical conductivity on conductive supports with a large number of active sites on porous surfaces. We used carbonized Nannochloropsis oculata cells as three-dimensional scaffolds for the synthesis of copper oxides, which have been previously shown to have HER electrocatalytic properties. Oculata algal cells were first converted to carbonized cells (cCells) with a biotemplate approach. CuOx nanoparticles were then grown on the cCells by a facile hydrothermal reaction, forming a CuOx-cCell composite (CuOx@cCells). The structure of the composite was analyzed by scanning electron microscopy and the HER electrocatalytic properties were studied by cyclic voltammetry and linear sweep voltammetry. The enhanced HER performance and stability of CuOx@cCells will be discussed in detail, in comparison with Pt/C benchmark HER catalyst.

112B. How to find an internship and maximize the benefits. Kassandra Cartrillo, Lashun Thomas. *Environmental Engineering, UA Little Rock, Little Rock, AR 72204.*

An epidemic is sweeping across college campuses striking fear into students everywhere. The epidemic is one of stress and anxiety by students seeking the perfect internship. We know internships can be a great way to strengthen your resume, but we are often clueless on how to actually find them, and how we can maximize the opportunity. College students are constantly told to find internships, but in most cases, it takes more than just googling "internships." Last summer, I had an internship with Alcoa in Bauxite, AR involving their chemical water treatment process. I will explain how to find an internship and how to make it, a one of a kind experience. I will outline the processes involved in (a) finding internship opportunities, (b) applying for internships, (c) preparing for an interview, and (d) maximizing the experience. I will show how being involved and putting forth some effort can also

help maximize your benefits. This includes learning from new experiences and developing new skills, work principles, teamwork, and life-long connections. I will discuss how to help jumpstart your career by making good impressions and building strong connections with the hosting company. Students will see that finding an internship that gives them the unique experience, not found in a classroom, is much easier than expected and will benefit them in more ways than just building their resume.

113A. Determination of Fatty Acid Concentrations in Algae. Stacy Justice, Andrew Williams, Haley Koenig, Makenzie Pierce, Kendall Wells, Jordan Kane, Roberto Bernal. *Chemistry, UA Monticello, Monticello, AR 71655.*

Algae are of scientific and commercial interest due to their ease of culture and high fatty acid content. It is reasonable to assume that different strains of algae contain different types and concentrations of fatty acids. Of particular interest is the fatty acid content contained within various algal strains in the class Eustigmatophyceae. The extracted fatty acids may be of potential use for human consumption during extended space travel. Additionally, the concentrations of fatty acids may also be useful for phylogenetic classification of new algal species. Algal strains were collected and isolated by UAM biologists from various locations, including Lake Chicot in Arkansas, Tower Pond and Lake Itasca at Itasca State Park in Minnesota, and Thayer Lake in the Upper Peninsula of Michigan. The strains collected were subjected to a five-step process for lipid preparation: lypholization, lipid extraction, filtration, esterification, and methyl ester extraction. The fatty acid extracts were analyzed using GC-MS. After qualitative determination of fatty acids by mass spectrometry, relative quantities of the fatty acids were determined by peak integration, and tricosanoic acid (C23:0) was used as a standard to determine absolute quantities. Preliminary results show differences between algal strains via relative fatty acid concentration.

113B. Phenomics Study of Arabidopsis Lines Over-expressing Genes in Myo-Inositol Pathway to Ascorbate under Water Deficit Stress. Jordan Iverson, *Chemistry, UA Pine Bluff, Pine Bluff, AR 71601;* Jessica P. Yactayo-Chang, Nirman Nepal, Natalie Turner, Zachary Campbell, Argelia Lorence. *Chemistry, Arkansas State University, Jonesboro, AR 72401.*

Vitamin C (L-ascorbic acid, ascorbate, AsA) is the most abundant water-soluble antioxidant found in plants. Ascorbate has a wide variety of physiological roles. It functions as an enzyme cofactor, as a radical scavenger, and protects tissues against damage caused by reactive oxygen species produced from stresses such as water deficit, soil salinity, cold, and heat. One of the great challenges we currently face in agriculture is the need to increase the productivity of crops capable of thriving under challenging environmental conditions to feed the growing population. One of the potential solutions to this challenge is the development of genetically modified plants with enhanced nutritional value, improved tolerance to stresses, and superior yields. The Lorence Laboratory has studied four enzymes involved in AsA biosynthesis via the myo-inositol pathway: myo-inositol oxygenase (MIOX), glucuronate reductase (GlcUR), gulonolactonase (GNL), and L-gulono-1,4-lactone oxidase (GuILO). In this work, we studied the effect of water limitation stress on the growth and health of Arabidopsis thaliana lines over-expressing AtMIOX, AtGNL, AtGuILO, and rGuILO enzymes. To measure plant growth and health we used a high throughput phenotyping platform equipped with visible, fluorescence, and near infrared cameras. We complemented that data with photosynthetic parameters measured using a hand-held fluorometer. Ascorbate measurements were done via an enzyme-based spectrophotometric assay. Our findings show that the over-expressers had higher foliar AsA content, displayed healthier color, water content and chlorophyll fluorescence profiles, and higher linear electron flow than the wild type controls. Based on this preliminary results we propose to make AtMIOX x AtGNL x AtGuILO crosses in the near future.

114A. Synthesis & Characterization of Pentadentate Ligands for the Formation of Binuclear Complexes. Anna Doner, Susanne Striegler. *Chemistry, UA Fayetteville, Fayetteville, AR 72701*.

There is a constant need in the scientific community for efficient and selective catalysts for the hydrolysis of glycosides for applications involving glycoproteins on the cell membrane. Some of the most efficient catalysts are artificial enzyme mimics containing metal ions such as Cu(II). The purpose of this study is to synthesize two pentadentate ligands to increase and decreasewith variable the intramolecular distance between the two copper ions in the ligands' corresponding binuclear complexes. These binuclear complexes will be evaluated as catalysts for the hydrolysis of glycosidic bonds in future work. The A step by stepstep-by-step synthesis and characterization of the pentadentate ligand 4-methyl-2,6-bis((pyridin-2-ylmethylamino)methyl)phenol) and its intermediates will be discussed here.

114B. Biomedical Evaluation of Ipomoeassin Natural Glycoresins. Guanghui Zong, Wei Q. Shi, *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

Bioactive natural products are a rich source of drug candidates as well as important tools for investigating

biological systems. Ipomoeassin F is a flagship congener of a macrolide resin glycoside family with an embedded disaccharide core. It possesses potent cell growth inhibition activity with IC50 values down to the single-digit nanomolar range. In the NCI-60 cell line screen, ipomoeassin F showed the average GI50 of ~30 nM. The low correlation indices (<0.5) from the COMPARE analyses suggest that ipomoeassin F has a novel mode of action. To understand how the natural product achieves its biological activity, we conducted a series of biological evaluations using chemical probes derived from ipomoeassin F, including cell imaging and chemical proteomics studies. To further harness scientific values of this unique chemical space, we report here also our most recent progress in both chemistry and biology for elucidating molecular targets of ipomoeassin F. The presented work paves the way for moving the ipomoeassin family of glycolipids into more advanced stages in biomedical research for drug discovery.

115A. Computational Analysis and Synthesis of Potential LpxC Inhibitors of LpxC. Rebeca J. Roldan, Carolyn F. Dishuck, Kayla A. Wilson, Mauricio Cafiero, Larryn W. Peterson. *Chemistry, Rhodes College, Memphis, TN 38112.*

The inhibition of LpxC, an enzyme involved in the first committed step of the biosynthesis of lipid A, is critical for the development of novel Gram-negative antibacterial treatments. Through computational analysis of its crystal structure, it was determined that LpxC contains three main regions of its active site: a zinc ion, a hydrophobic passage, and a polar region. Potential inhibitors that mimic the natural substrate of LpxC have been designed. The computational analysis and synthesis of these novel analogues, as well as their chemical stability, will be discussed.

115B. Hindering Outer Membrane Formation in Gram-Negative Bacteria through Competitive Inhibition of LpxC. Andrea Pajarillo, Sarah Malkowski, Gene Lamanilao, Maruicio Cafiero, Larryn Peterson. *Chemistry, Rhodes College, Memphis, TN 38112.*

Numerous strains of Gram-negative bacteria have exhibited resistance against multiple types of antibiotic treatment, causing life-threatening and untreatable infections. Furthermore, the increasing incidence of multidrug resistance necessitates the discovery of new mechanisms to treat Gram-negative bacterial infections. A particular target of interest is LpxC, a highly conserved enzyme in Gram-negative bacteria, which plays a key role in the biosynthesis of the Lipid A. Embedded in the outer membrane of live Gram-negative bacteria, the endotoxin Lipid A is essential to the structural integrity of the outer membrane and also triggers an overactivation of the immune system, leading to organ failure and death. The LpxC active site consists of a zinc ion, a polar region, and a hydrophobic passage. This research aims to design and synthesize compounds that can competitively inhibit LpxC with high specificity.

116A. Spectrophotometric Analysis of Animal Stones Through Infrared Spectroscopy. Nathan Taylor, Russ Summers, Jim Winter. *Chemistry, UA Little Rock, Little Rock, AR 72204.*

The buildup of certain compounds and elements can produce stones in some mammals that can be harmful if left untreated. By learning how to change an animal's diet, we can potentially prevent additional stone formation. My project was to chemically analyze kidney stones from live animals. I performed my analyses on stones from dogs, cattle, and pigs. Using FT-IR spectroscopy, I analyzed the chemical structure of about 50 different stones. I used four scans per stone to assure more accurate results as well. To begin, the stone was crushed into a fine powder and dried in an oven. It was then mixed with potassium bromide, (KBr), and a spectrum was taken. I performed these analyses through the use of a Perkin-Elmer Two FT-IR Spectrometer with DRIFT accessory (Diffuse Reflectance Infrared Fourier Transform), which is an IR spectroscopy unit. From there, the results were analyzed and a determination on the species of stone was made. After my determination, the fingerprint region of the IR spectrum was read to decide if the animal's diet should be changed in order to increase or decrease necessary elements such as potassium, calcium, and/or sodium. Once this information was obtained, a detailed report was sent to the vet who sent in the stone to determine if a change in diet was necessary. This process was completed the same way for each stone obtained, amount permitting. Most of the stones were mainly composed of struvite, calcium oxalate, or oxalate. With our evaluations, the vet could make a more informed decision on what needed to change in the animal's diet in order to help the animal.

116B. Enhanced Microdialysis Sampling of Flurbiprofen by use of β-Cyclodextrin. Lora Heath, *Chemistry, UA Little Rock, Little Rock, AR 72204;* Julie A. Stenken, *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

The enhanced microdialysis relative recovery of a hydrophobic drug, flurbiprofen, is discussed. Through the use of an affinity agent, β-cyclodextrin, in the perfusion fluid, an enhancement of relative recovery is tested. This used a microdialysis probe with a polyethersulfone, 10 mm membrane for microdialysis sampling. Without β-cyclodextrin RR%: 59.9%, 58.2%, 55.7%. With β-cyclodextrin RR%: 54.3%, 85.7%, 33.0%.

117A. Producing and studying stilbenoids. Jeremiah Jeffers, *Biology, UA Pine Bluff, Pine Bluff, AR 71601;* Fabricio Medina-Bolivar, Patrick Roberto, Abbas Karouni. *Chemistry, Arkansas State University, Jonesboro, AR 72401.*

Stilbenoids are inducible defense compounds produced by certain plants, including grapes and peanuts. In addition to their role in plant defense, they have potential applications in human health due to their antiviral, anticancer, neuroprotective, and anti-obesity properties. The peanut plant produces a unique class of stilbenoids, i.e. prenylated stilbenoids, upon fungal challenge. These compounds have shown higher metabolic stability than non prenylated stilbenoids and are potentially more bioavailable than their non prenylated analogues.
In order to study the antioxidant properties of prenylated stilbenoids, peanut hairy roots were used as a bioproducion system for these compounds. The hairy roots were treated with elicitors for 48, 108 and 168 hours and the stilbenoids were extracted from the culture medium with ethyl acetate and analyzed by HPLC. The extracts contained the non-prenylated stilbenoids resveratrol and piceatannol and the prenylated stilbenoids arachidin-1, -2, -3 and -5. Higher levels of prenylated stilbenoids were obtained after 168 hours of elicitation. Antioxidant assays will be performed to determine if the antioxidant capacity is higher in the extracts than purified stilbenoids. These studies demonstrate the application of peanut hairy roots to produce bioactive compounds for human health.

117B. The Regulation of CYP1B1 by Inflammation in Human Hepatocytes. Shamara Lawrence, *Chemistry, UA Pine Bluff, Pine Bluff, AR 71601.* Wen Xie, Hung Chun-Tung. *Molecular Pharmacology, SURP, University of Pittsburgh, Pittsburgh, PA.*

Background & Aims: Chronic inflammatory liver disease is associated with increased level of CYP1B1 in human liver. The objective of this study is to assess the contribution of CYP1B1 in human hepatocytes treated with pro-inflammatory cytokines, and to determine if NF-κB signaling pathway is responsible for the regulation of CYP1B1 in human hepatocytes under inflammatory condition.
Methods: We performed real-time PCR and western blot to analyze expression of CYP1B1 in Huh7 cells and human primary hepatocytes (HPHs) treated with NF-κB activators, tumor necrosis factor alpha (TNF- α) and phorbol 12-myristate 13-acetate (PMA), for 24 hours. The regulation of CYP1B1 by NF-κB pathway was investigated by using NF-κB inhibitor, pyrrolidine dithiocarbamate (PDTC).
Results: CYP1B1 was induced in both Huh7 and HPHs treated with TNF-α and PMA. However, pharmacological inhibition of NF-κB signaling did not showed any significant decrease in CYP1B1 expression during inflammation.
Conclusions: Our results showed that CYP1B1 expression was inducible in human hepatocytes treated with TNF- α and PMA, suggesting the relationship between CYP1B1 and hepatic parenchymal inflammation. However, the inflammatory activation of CYP1B1 was not mediated by NF-κB signaling pathway.

118A. Photothermally Controlled Release of Ceftaroline Fosamil Using Polydopamine-Coated Gold Nanocages. Brayley Gattis, Tengjiao Wang, Jingyi Chen. *Chemistry, UA Fayetteville, Fayetteville, AR 72701*.

Antibiotic formation of new compounds and drugs cannot keep up with the rate at which bacteria evolve. Currently, the formation of traditional drugs will ultimately lead to the continued emergence of resistance. According to the CDC, over 2 million people annually in the United States alone become infected by bacteria that are resistant to antibiotics. Bacterium like Staphylococcus aureus – which leads to the well-known MRSA infection – are often present in hospitals, sometimes causing those who are sick to become even worse.
Because conventional drugs cannot sufficiently surmount many bacterium's ability to fight off infections, different paths must be pursued. Drug delivery using nanoconstructs has been identified as an alternative way to deliver antibiotics and has shown promising results in clinical trials. The nanoconstructs used in this project are gold nanocages coated with the polymer polydopamine. The antibiotic is Ceftaroline fosamil (CF), which is the first broad-spectrum drug of its kind, to be put forth for clinical use in the United States against methicillin-resistant Staphylococcus aureus (MRSA). CF has been shown to have bactericidal tendencies against Gram-positive aerobes like hospital or community acquired MRSA. Photothermal therapy (PTT) affects the controlled release of the drug, and is not only proven to eradicate pathogens via light absorbers like gold nanoparticles, but also can cause the release of CF from the polydopamine-coated gold nanocage. This combination maximizes the effectiveness of the gold nanocages in the fight against infectious diseases.

118B. Optimization and Synthesis of Zn-CuInS2/ZnS Quantum Dots. Jean Morales, Anh Nguyen, Colin Heyes. *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

Since the start of the present decade, the synthesis of non-toxic semiconductor nanoparticles has continuously attempted to replace the use of their traditional cadmium-based counterparts. Zn-CuInS2/ZnS core/shell quantum dots are non-toxic semiconductor

nanoparticles synthesized in a two-step process. This process consists in the fabrication of core Zn-CuInS2 particles, as well as the subsequent deposition of a ZnS-based shell. Different molar ratios of Zn2+:Cu2+ (1:1, 2:1, 4:1, 8:1) were investigated to find an optimum fluorescence of the core particles prior ZnS shell deposition. The highest quantum yield for the Zn-CuInS2 core nanocrystals was 19 % when the reaction was carried for 70 minutes employing a 2:1 Zn:Cu molar ratio at a temperature of 230 °C. After coating the optimized core particles with the ZnS shell, the quantum yield was increased to 45%, almost three times as large as those of the optimized non-coated cores.

119A. Synthesis of Multi-Modal Drugs Toward the Treatment of Chagas Disease. Rachel M. Senn, Gregory R. Naumiec. *Chemistry, University of Central Arkansas, Conway, AR 72035.*

Neglected tropical diseases affect over 1 billion people per year, causing effects that range from fever to heart and bowel failure. Some of the more well-known illnesses of this class include Malaria, Rabies, Leprosy, and African Sleeping Sickness. While these maladies are fairly simple in their nature, they are considered neglected because of the lack of research or drugs available to treat them. The main focus of our research, Chagas disease, falls under this category. Chagas disease manifests itself in two forms, the acute phase which causes fever and swelling of the spleen and liver, and the chronic phase which is thought to be the leading cause of heart disease in Latin America, in countries such as Argentina, Brazil, and Bolivia.

Our research focuses on creating multi-modal drugs for the treatment of Chagas disease using short synthetic pathways and inexpensive starting materials.
In working to produce a multi-modal drug for Chagas disease we have started with a relatively inexpensive compound, commonly known as squaric acid. While this compound has shown some anti-Chagistic properities of its own, one of its main features is its ability to be further functionalized after being converted to a squaramide, a known class of anti-parasitics that target Chagas disease. Our current work is focused on converting squaric acid to a squaramide via an intermediary dimethyl ester by substituting two di-amino “arms” that are capable of further modification. In the future, we hope to perfect this first step in order to facilely create a novel library of compounds with different functional groups that may prove to be potent against Chagas disease.

119B. Squaramide-based Anti-parasitic Drugs toward the Discovery of Novel Treatments for American Trypanosomiasis.
Emily N.H. Tran, Gregory R. Naumiec. *Chemistry, University of Central Arkansas, Conway, AR 72035.*

American trypanosomiasis, or Chagas disease, is a neglected tropical disease caused by the parasite Trypanosoma cruzi, affecting one sixth of the world’s population most prevalently in Central and South America. The two current treatments for Chagas disease utilize the drugs Nifurtimox and Benznidazole, potent anti-parasitic medications that eliminate T. cruzi. Though effective drugs, their side effects are extremely harsh, including difficulty eating or passing stool and cardiac complications, which could result in sudden death. Therefore, this research project focuses on the production of a library of drug candidates that are inexpensive yet innocuous to treat Chagas disease. The synthesis of squaramide-based drug derivatives from 3,4-Dihydroxycyclobut-3-ene-1,2-dione (squaric acid) has shown to have anti-parasitic properties against T. cruzi. Squaric acid is first converted to squaric esters via condensation with alcohols and are subsequently converted to the targeted squaramides. This class of compounds have demonstrated to have short synthetic pathways, low toxicity in humans, and the potential for high affinity for the T. cruzi parasite. Through a series of condensation reactions of three to four steps, an assortment of potential drugs is being be created from alkyl and aryl amines. The availability of these compounds will enhance the chances of discovering a new and safer medication for Chagas disease. Currently, significant progress has been made in the synthesis of the first generation drug library. Future research involves testing the potency of these drug candidates and synthesizing a second generation of drug derivatives.

120A. Towards the Synthesis of 1,4 Triazoles as Inhibitors of Glutamate Receptor as Potential Treatments for Autism Spectrum Disorder. Kristofer Provins, James Donelson, Brandon Kerr, Blake Overman. *Chemical & Physical Sciences, Missouri Southern State University, Joplin MO 64801.*

It is estimated that ~1% of the population is affected by autism spectrum disorders (ASDs). These conditions are generally characterized by two essential symptoms; impaired communications and social interactions as well as restricted and repetitive behaviors. It is evident that many of those suffering from ASDs have an increased level of the neurotransmitter glutamate. Glutamate plays a large role in the central nervous system as being the key excitatory neurotransmitter for nearly 90% of the neurons in the brain. There are multiple different types of glutamate receptor, with the metabotropic glutamate receptor 5 (mGluR5) being of particular interest in ASDs. It is believed that drugs that target mGluR5 and inhibit its function could potentially lessen some of the traits associated with ASDs. This project uses a three-step reaction sequence to synthesize substituted 1,4-triazoles as potential inhibitors to mGluR5. The first reaction involves synthesizing various

substituted benzyl azides via treating benzyl halides with sodium azide and microwaving. The azides were synthesized with crude yields ranging from 70.0% to 82.9%. The 2nd step involves synthesizing substituted benzylic terminal alkynes via treating a solutions of benzyl halides with sodium acetylide and refluxing. This method does not appear to be an effective method of synthesizing benzylic terminal alkynes. Crude yields of these reactions ranged from 0% to 74.5%.

120B. Designing the catalytic activity of microgels by targeted substitution of acrylate monomers. Madison Whaley, Susanne Striegler. *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

There is a significant interest in the scientific community involving the use of macromolecular catalysts to mimic enzymes for the hydrolysis of glycosidic bonds. The development of fast and convenient methods of catalytic transformation on carbohydrates will help to illuminate tactics to treat neurodegenerative disorders such Alzheimer's and Tay-Sach's disease. Previously, our research group has shown that VBbpdpo-ligand containing macromolecules are effective biomimicking catalysts. These polymers were synthesized using an ethyleneglycol dimethacrylate cross linker, butyl acrylate, and VBbpdpo ligand; for this project, the composition of butyl acrylate will be substituted by varying amounts of acrylate monomer to observe its effect on catalytic activity. The effect of the acrylate substitution under the same pH value, temperature, dilution of polymer mix, and crosslinking amount will be determined using gravimetric analysis. This analysis will reveal the correlation between the polyacrylate matrix surrounding the macromolecular catalyst and the subsequent catalytic activity of the macromolecular catalyst. The results of this research will provide crucial information for biomimicking catalysts used for medicinal therapy and in the industry.

121A. Modulation of heparin binding affinity, stability and cell proliferation activity of Human acidic Fibroblast Growth Factor 1 (FGF1). Amrit Kannan, Shilpi Agrawal, T.K.S. Kumar. *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

Human acidic Fibroblast Growth Factor 1 (hFGF1) is an integral, positively-charged protein involved in various cell proliferation and developmental processes. To function effectively, naturally-occurring wild type FGF1 (wtFGF1) requires intermolecular interactions with the anticoagulant heparin, which is negatively charged. However, the exact role of heparin is still unknown. Therefore, this study aims to design several FGF1 variants in the heparin binding pocket, K112 (K126), to co-relate the heparin dependency of FGF1 with the stability. We examined their biophysical and biological property by- far UV- circular dichroism spectroscopy, isothermal titration calorimetry and cell vialibity analysis using trypan blue. The circular dichroism spectroscopy results showed that the mutations cause substantial increase in the thermal stability without altering the native secondary structure of wtFGF1. The data from isothermal calorimetry revealed that the heparin binding affinity is significantly reduced for all the mutations when compared to the wtFGF1. However, the cell viability analysis using trypan blue concluded that the there is insignificant difference between the biological activities of the mutations when treated - in presence and absence of heparin. Thus, the above results clearly indicate that heparin is unimportant for the function of wtFGF1.

121B. Molecular Dynamics (MD) of a Zinc Finger Protein. Hayden Hairston, Mahmoud Moradi. *Chemistry, UA Fayetteville, Fayetteville, AR 72701.*

Zinc finger proteins are some of the most abundant and diverse proteins in our world today. This project uses molecular dynamics programs, NAMD and VMD, to find suitable semi-precious replacements for zinc in the polypeptide. The particular zinc finger in this project, pdb:1aay, is a three-fingered complex that is fundamental to transcriptional regulation, but has applications beyond the cellular level. This project plans to use this protein in conjunction with another lab to produce nanoparticle clusters that can be used to catalyze reactions.

122A. Adsorption of VOCs on the Surface of Aerosol Salts. Jesse Brown, Hashim Ali. *Chemistry, Arkansas State University, Jonesboro, AR 72401.*

Volatile organic compounds (VOCs) are found in the atmosphere and often contribute to the climate chemistry and therefore influence the climate in general. For example, some low molecular weight acids a like succinic and malonic acid have been found to contribute to the formation of smog and acid-rain. To study their chemistry, an aerosol flow system was constructed to study the adsorption of such acids on the surface of aerosol particles, which consist mainly of metal salts, in this case calcium carbonate. The areas of the peaks were plotted versus time. This showed a first order reaction. The plot showed equilibrium was reached in 60 min. This shows fast adsorption kinetics, which would lead to faster removal of VOCs from the atmosphere.

122B. Potential Coexpression of Heterodimeric Thiosulfate Dehydrogenase in Halothiobacillus neapolitanus. Nicholas La Roe, Megan Hand, N. Hilliard. *Department of Physical Sciences, Arkansas Tech University, Russellville, AR 72801.*

Halothiobacillus neapolitanus is an obligate chemolithoautotroph capable of utilizing the extracytoplasmic oxidation of inorganic sulfur compounds as its sole source of metabolic energy. Unlike other sulfur oxidizing microbes capable of utilizing thiosulfate as an energy source, genomics data has shown the presence of a gene for a potentially heterodimeric thiosulfate dehydrogenase (tsdAB). The putative fused gene, comprised of Hneap_1476 and Hneap_1477, contains an ATGA motif indicating potential for coexpression of the two genes with a 1:1 stoichiometry. In addition, the ATGA sequence is accompanied by a putative Shine-Delgarno region that exists between 7 and 12 bases upstream of the ATGA sequence. Also, sequence alignment of the Hneap tsdAB gene against genes from species reported to produce a monomeric thiosulfate dehydrogenase indicates the presence of a 'spacer' of bases between the end of the 'monomeric genes' and the Shine-Delgarno sequence in the fused gene. These features together lend support to the hypothesis that the two genes are coexpressed. In order to verify the tsdAB subunit stoichiometry, PCR primers were designed to amplify the entire Hneap_1476/1477 gene coding region including the region surrounding the gene fusion site. All PCR amplicons indicate a fragment near the predicted size of ~1638 bases. Mutagenic primers have been designed to remove/modify the Shine-Delgarno region.

123A. Expression and Purification of Calmodulin Binding Partner PEP-19. Hannah Simpson, Christian Mitchell, Tori Dunlap. *Chemistry, University of Central Arkansas, Conway, AR 72035.*

Calmodulin (CaM) is a calcium-sensing protein that plays a role in regulating enzyme activity. Usually, CaM binds to a disordered region and causes the region to have an α-helical secondary structure. PEP-19 is a totally disordered 62 amino acid protein that is found in purkinje cells in the cerebellum. When PEP-19 binds to CaM, the rate that calcium binds increases and alters calcium binding kinetics. To investigate PEP-19's conformational ensemble, purified PEP-19 was made using E. coli and an expression method called autoinduction. Autoinduction is a unique method that uses specific proportions and concentrations of glycerol, glucose, and lactose, 5052, to cause the production of PEP-19 without needing to monitor cell growth. Traditionally, autoinduction utilizes a specific autoinduction media which contains a complex variety of ingredients making it costly and time consuming to make. The original method for preparing PEP-19 was done by using an IPTG method, which is, yet again, inconvenient and time consuming due to the need to monitor cell growth. The IPTG method often requires the use of a simple, cost effective media called Terrific Broth (TB) that utilizes glycerol as the carbohydrate source. We hypothesized that TB could be used for autoinduction by replacing the standard glycerol with the 5052 mixture from the autoinduction. Here we compare the expression of both CaM and PEP-19 utilizing the IPTG method, standard induction method, and autoinduction method using TB and 5052 to determine if utilization of TB and 5052 can provide a convenient, cost effective alternative to the IPTG and standard autoinduction methods. We hope to apply these same methods to the production of both RAC kinase, and Calcineurin (CaN), which we are using to compare varying expression methods.

123B. Fighting Drug Resistant Mycobacterium tuberculosis with Modified Rifamycins. LaShawna Miller, Jordan Trant, Zachary Hodge, Emerson Smith, Irosha N. Nawarathne. *Chemistry, Lyon College, Batesville, AR 72503.*

Mathematics and Science Division, Lyon College, Batesville, AR, 72501 Tuberculosis, which is caused by the bacteria Mycobacterium tuberculosis, is a lung disease which kills roughly 1.5 million people a year. The most common family of antibiotics for this disease are rifamycins, which were developed 40 years ago. Rifamycins work by binding to the RNA polymerase (RNAP) and inhibiting RNA synthesis. The bacteria has since mutated in multiple ways that have decreased the effectiveness of rifamycins. Although there are many rifamycin resistant (RifR) strains of MTB, the mutations of three residues, D435V, H526Y, and S450L, account for 84% of the MTB RifR strains. Our research focused on S450L, which accounts for about 43% of the MTB RifR strains. The mutation causes the replacement of a serine amino acid with a leucine, which is both bulkier and more hydrophobic. This creates steric hindrances between drug molecule and RNAP, allowing the bacteria to continue RNA synthesis. We are attempting to change the structure of rifamycin so it will bind to the RNAP site better. We hypothesize that we can get the desired result by removing the hydroxy on the C-8 position through chemical deoxygenation or a fluorination. Being smaller and more hydrophobic, rifamycin analogue with the hydrogen or fluorine at C-8 will bind to the MTB RifR strains more effectively. Furthermore, fluorine incorporated rifamycins are proposed to be developed as an imaging agent tofacilitate diagnosis through TB screening, thus promoting prevention and/or early treatment of the disease. We have used this protocol on 1-hydroxyanthra-9,10-quinone to test the reaction efficiency. Then we continued the deoxygenation at C-8 position of rifamycin S with some measure of success

that will be discussed in our presentation. The deoxygenated rifamycins are tested with mutated RNAP in an in vitro transcription assay that is based on rolling circle transcription technology. This work is supported by Arkansas IDeA Network of Biomedical Research Excellence (Arkansas INBRE) and Lyon College.

Physics

Friday Oral Platform Session

ORAL – 3:20 Suppression of Radiation-Induced Chromosome Damage by vitamin E Gamma-Tocotrienol. Kassey Cole, Abdel Bachri, Rupak Pathak, and Martin Hauer-Jensen. *Engineering and Physics Department, Southern Arkansas University, Magnolia, AR 71753.*

Ionizing radiation, such as outer space radiation, generates reactive oxygen species (ROS), which causes cytogenetic alterations originating from Chromosome damage. Because antioxidants are potent ROS scavengers, we investigated whether the vitamin E γ-tocotrienol (GT3), a radio-protective multifunctional dietary antioxidant, can suppress radiation-induced cytogenetic damage. We found that GT3 pretreatment reduced double strand break formation in HUVECS, and decreased chromosome aberration in HUVECs after irradiation. Moreover, GT3 increased expression of the DNA-repair gene RAD50 and attenuated radiation-induced RAD50 suppression. We conclude that GT3 attenuates radiation-induced cytogenetic damage, possibly by affecting RAD50 expression. GT3 should be explored as a therapeutic supplement to reduce the risk of developing genetic diseases after radiation exposure.

ORAL – 3:35. A Study of Hybrid Electric Propulsion Solutions for Short Range Commuter Operations. Mercedes Winfrey, *Chemistry and Physics, UA Pine Bluff, Pine Bluff, AR 71601, and Ronald J. Ankner, Steven's Institute of Technology, Hoboken, NJ.*

As conventional gas turbine propulsion technologies approach the upper limits of improvements in efficiency and emissions, a new paradigm shift can be seen on the horizon within the commercial aviation industry: hybrid electric propulsion systems. To overcome inefficiencies inherent in switching from mechanical to electrical power, hybrid electric aircraft will need to take advantage of novel effects. These effects include higher effective bypass ratio and induced wing lift from distributed propeller/fan arrangements along with dynamic load handling. Systems studies were performed for an on-demand mobility aircraft platform with a passenger capacity of approximately seven. This platform is envisioned to remedy the prohibitively long wait times a passenger on a conventional aircraft would face at their airport if they were to take a short-range flight. Vehicle flight configurations, mission contingencies, gas turbine and generator sizing, and battery sizing were all main considerations within the systems study. Virtual gas turbine models were built within both NPSS (Numerical Propulsion System Simulation) and T-MATS (Toolbox for Modeling and Analysis of Thermodynamic Systems). Furthermore, a plan to develop a low-cost turbine/generator testbed centered on a JetCat SPT5 hobbyist size turboshaft engine has been drafted. The JetCat SPT5 turboshaft will be paired with commercial generator and power conversion systems for the first phase of the testbed to verify models and characterize the dynamic nature of the system. Hybrid-electric systems have the possibility to make a massive impact on aerospace designs. In supplementing energy normally provided by fuel with electric energy, hybrid-electric systems make available a host of aircraft architectures that were never before feasible. Moreover, they provide a robust system for small commuter aircraft which both reduce fuel consumption and increases turbine efficiency. Overall, the investigation of these systems incorporated a study of the system as a whole and aircraft architecture, computational models of turbine engines and generators, and a physical testbed to characterize the dynamic response of turboelectric systems. Out of these efforts, it was concluded that a vehicle of weight 7000 pounds, L/D of 16, and a disk loading of 10 lb/ft2 was optimal for a hybrid-electric system performing a nominal mission of approximate range 200 miles and speed 150 mph.

ORAL – 3:50. Noise Hunting: Mitigating Noise Sources in Virgo pre-O2. Irene Fiori, Nathan Flood, Soumen Koley, Federico Paoletti, Antonio Pasqualetti, Flavio Travasso. *Physics Department, Pittsburg State University, Pittsburg, KS 66762.*

Firstly we'll discuss the significance of Virgo and LIGO collaboration to the greater astrophysical and scientific community, and how we are able to make the smallest measurements humans have ever made to observe the most energetic cosmic events ever observed. In this poster we'll analyze the noise hunting methods and tools developed and used at Virgo prior to entering the 2017 observing run with aLIGO (O2). In addition we'll discuss the noise sources mitigated and/or eliminated. This poster will also include an overview of a few MATLAB tools developed that can be used in future noise hunting campaigns. Through a culmination of the efforts of the entire commissioning team, including the

noise hunting team, Virgo has been able to achieve record sensitivity and stability. If during O2 Advanced Virgo and aLIGO have a triple detection this could provide not only a triangulated sky location, but with the sky location particle detectors may be able to better observe the particles emitted by the cosmic event detected. This would provide the opportunity to further understand these extraordinary cosmic events such as black hole-black hole mergers and neutron star mergers.

ORAL – 4:05 Dynamic Response of Yeast Cells using Automated Microfluidic Devices. Sophia McKinney and Pradeep Kumar, *Engineering and Physics, Southern Arkansas University, Magnolia, AR 71753.*

Temporal regulation of gene expression plays an important role in cellular responses to external stresses. Regulatory pathways ensure that cells are able to respond to temporal environmental changes by regulating the production of various proteins in a time-dependent manner. While response of cells to steady stress of the environment is widely investigated, the response of the cells to temporal changes in environments such pH, nutrients, and temperature is poorly understood. The amount of information carried by a pathway depends on the bandwidth of the pathway [1,2]. Microfluidic devices are excellent tools in which the flow of different media in micro channels containing cells can be controlled and regulated in a temporal manner and therefore allowing the access to temporal changes in gene expression of various proteins of interest. A microfluidic device will be created using soft lithography. For this, a silicon wafer will be coated in a photoresist (SU8 3010, Microchem USA) to a thickness of 10 µm. It will then be exposed to UV light through a photomask containing the designed channeling in order to cure the parts exposed. Through a developing process, the rest of the photoresist will be etched away resulting in a master mold that will be used to imprint the micro channels on Polydimethylsyloxane (PDMS). This will then be bonded to glass and mounted on a microscope for further experiments. The flow of different media will be controlled using high-pressure reservoirs and pneumatic valves interfaced with an Arduino microprocessor. With this we will use the device to measure cellular responses of budding yeast Saccharomyces Cerevisiae (S. Cerevisiae) with temporal changes in pH. S. Cerevisiae grows better at acidic pH conditions as compared to neutral or alkaline pH; therefore, a media of alkaline pH presents stress to the cells. Recent studies suggest that the alkaline pH sensing in yeast cells is mediated by Slt2 MAPK pathway budding yeast with time dependent phosphorylation of Slt2 upon pH shock [3]. We will use yeast cells where the gene expression level of Slt2 can be monitored upon pH shock of different periodicity in order to quantify the bandwidth of the pathway.

ORAL – 4:20. Ultrasonic bone assessment using a time domain analysis of backscatter signals from cancellous bone. Phoebe C. Sharp, Jordan P. Ankersen, Joseph A. McPherson, Ann M. Viano, and Brent K. Hoffmeister. *Dept. of Physics, Rhodes College, Memphis, TN 38112.*

Background: Ultrasonic backscatter techniques are being developed to detect changes in cancellous bone caused by osteoporosis. Most techniques analyze backscatter signals in the frequency domain by measuring quantities related to the power spectrum. Goal: Determine if a time domain technique that measures the backscatter amplitude decay constant (BADC) is sensitive to changes in the trabecular microstructure of cancellous bone caused by osteoporosis. Methods: A 3.5 MHz transducer was used to acquire backscatter signals from 54 cube-shaped specimens of human cancellous bone prepared from the proximal end of 14 human femurs. BADC was determined by measuring the exponential decay in the amplitude of the backscatter signal. High resolution x-ray micro-computed tomography was used to measure microstrucutural characteristics of the specimens. Results: BADC demonstrated highly significant linear correlations with trabecular thickness and geometry ($p < 0.001$). Conclusions: Parameters based on a time domain analysis of backscatter signals from cancellous bone may be sensitive to changes in the microstructure of cancellous bone caused by osteoporosis. Funding: NIH/NIAMS R15AR066900.

ORAL – 4:35. Molecular Dynamics Simulations of Layered Metallic Systems. Austin Bollinger and Ridwan Sakidja, *Physics Dept., Missouri State University, Springfield, MO 65897.*

This project studies the effects of compression on the mechanical deformation of layered metallic systems, specifically made of Pb. The study of compression mechanics can be applied to many fields of metallurgy, and in this case in the application of the mechanical modeling to elucidate the rolling process mechanisms as an essential part of the lead battery fabrication. By employing the molecular dynamics simulation, the roles of thermodynamics, compression rate, and sample size can be carefully evaluated so as to optimize of both strength and cost efficiency.

Physics

A and B – Saturday 8:00 – 10:15 Posters

201. Ultrasonic bone assessment using a backscatter difference technique in human volunteers. Abel Diaz, Ann M. Viano, Brian S. Garra, Brent K. Hoffmeister. *Physics Department, Rhodes College, Memphis, TN 38112.*

Background: Ultrasonic backscatter techniques have been proposed as a way to detect changes in bone tissue caused by osteoporosis. One parameter, called the normalized backscatter amplitude ratio (nBAR), measures the log of the amplitude ratio of two different portions of the backscatter signal. Goal: The goal of this study was to determine if nBAR correlates with bone density measured in human volunteers. Methods: Ultrasonic backscatter images and signals were acquired from the hip and two vertebral bodies using a 2.5 MHz phased-array transducer. Dual energy x-ray absorptiometry (DXA) was used to measure bone mineral density (BMD) at the same locations. Results: In most cases, nBAR demonstrated a statistically significant correlation ($p < 0.05$) with BMD. Conclusions: nBAR may be sensitive to changes in bone density caused by osteoporosis. Funding: NIH/NIAMS R15AR066900

202. Quantitative Binding Analysis of Mn2+ to DNA Hairpin Loops. Thomas Edward Owens, William A. Gunderson, Julie C. Gunderson. *Biochemistry and Molecular Biology, Hendrix College, Conway, AR 72032.*

Single-stranded DNA with palindromic or partially palindromic repeating sequences can pair up to form thermodynamically stable hairpins or 'slipped-strand DNA structures' during DNA replication. If left un-repaired, the formation of these extra helical DNA loops can result in the insertion or deletion of genes from the genome. Inefficient repair of hairpin loops underlies mutations responsible or over 30 neurodegenerative diseases and many cancers in humans. Previous experiments have shown that some hairpin loops have conformational dynamics that are dependent on the presence of divalent metal cations, and the conformational dynamics of these hairpins prevent mismatch recognition proteins from properly recognizing and initiating the repair of these slipped strand DNA structures. Our research seeks to identify the role that these ions play within slipped-strand DNA structures. The objective of this project was to quantify the number of M n2+ binding sites and the metal affinity (KD) of those sites within DNA hairpins bearing triplet repeat sequences. To examine the binding activity, the affinities and number of metal binding sites were quantified using Electron Paramagnetic Resonance (EPR) Spectroscopy. DNA hairpins of various lengths and sequences were titrated with MnCl2 and the concentration of free/bound Mn2+ ions in solution were quantified through integration of the EPR spectrum. The binding isotherm was fit using a Hill equation. These titrations revealed the presence of one high affinity Mn2+ binding site for perfectly paired hairpin sequences and multiple Mn2+ binding sites for hairpins containing base pairing mismatches from partially palindromic sequences. Our study demonstrates that EPR spectroscopy can be used to quantify the number of divalent metal ion binding sites in hairpin DNA structures. This data will help us to determine the structural role that divalent ions play in slipped-strand DNA molecules and will ultimately help us predict the interaction of DNA processing enzymes with these structures.

203. Computational Investigations of Hydrous Aluminosilicate Melts. Jesse Underwood, Robert Mayanovic, Ridwan Sakidja. *Physics, Astronomy, and Materials Science, Missouri State University, Springfield, MO 65897.*

Water dissolution plays a key role in modifying the physical properties of silicate melts, thereby directly impacting upon the eruptive power of magmas in volcanoes and the mass transfer associated with magmatic processes. Studies of water-melt interactions at the atomic level will lead to a better understanding of the water cycle and plate tectonics on Earth, which is useful to help constrain habitable zones of rocky exoplanets. In the past, there were no detailed structural data of hydrous (i.e., with soluble water) silicate melts. Synchrotron high energy x-ray diffraction measurements have been made by our group of an albite melt in contact with water to high pressures and temperatures in order to obtain structural information on the system. This new structural data provided motivation to explore water-melt interactions and the atomistic structure of the hydrous albite melt using molecular dynamics (MD) simulations. In this work, we discuss our large simulation-cell MD calculation s being carried out using ReaxFF potentials to model water-melt interactions and to make a detailed quantitative structural determination of the hydrous albite melt system.

204. An ultrasonic backscatter technique for measuring changes in the microstructure of cancellous bone caused by osteoporosis. Joshua T. Moore, Jinsong Huang, Luke C. Fairbanks, Sheldon C. Ebron, Jordan P. Ankerson, Matthew T. Huber, Abel A. Diaz, Ann M. Viano, Brent K. Hoffmeister. *Physics Department, Rhodes College, Memphis, TN 38112.*

Background: Ultrasonic backscatter techniques are being developed to detect changes in bone caused by osteoporosis. A new technique, called the backscatter

difference technique, compares the power difference between two portions of a backscatter signal from cancellous bone. Cancellous bone is a normally porous bone tissue that becomes increasingly porous with osteoporosis. Goal: The purpose of this study was to investigate the sensitivity of a parameter called the normalized mean of the backscatter difference (nMBD) to changes in the microstructural characteristics of cancellous bone. Methods: Ultrasonic measurements were performed with a 3.5 MHz broadband transducer on 54 specimens of human cancellous bone. Microstructural parameters and bone mineral density (BMD) were measured using x-ray micro-computed tomography. Results: nMBD was found to correlate strongly with BMD and several of the microstructural parameters. In addition, multivariate statistical analysis found that nMBD correlated with some of the microstructural characteristics independently of BMD. Conclusion: nMBD may be sensitive to microstructural changes in cancellous bone caused by osteoporosis.

205. Design and Construction of a Low-Cost Multi-Mode Microscope. Reed Spivey, Julie Gunderson. *Physics Dept., Hendrix College, Conway, AR 72032.*

High-quality fluorescence imaging is difficult to accomplish without the use of expensive instrumentation. Institutions without the budget to afford microscopy instruments capable of fluorescence detection are therefore limited in breadth of research. Here, we describe the construction of an open-source, modular, multi-mode microscope that serves as the structural basis for fluorescence implementation. The modular design of our microscope allows for easy modification of independent elements within the system such as light source, optical path, and detection apparatus. Traditionally, a CCD camera is used as the detection device in a fluorescence microscope. The low light sensitivity and high-quality images make CCD cameras ideal; however, even a low-cost CCD camera is expensive relative to comparable alternatives. For our microscope, we used the Raspberry Pi Noir, a low-cost CMOS camera with low light capability. The microscope is designed in a way that multiple detectors can be easily installed simultaneously. We used 3D printed parts to replace more expensive structural components of our microscope. The 3D design and printing technologies allowed us to create very low-cost optical mounts which normally make up a large portion of the total cost of an open-source microscope. We tested the magnification and resolution of our microscope in a bright-field configuration using a stage calibration micrometer and compared the low-light capabilities of the Raspberry Pi Noir versus the low-cost CCD camera.

206. Modeling the effect of hemodynamic forces on the migration of smooth muscle cells towards blood vessels. Eiad Hamwi, Ridwan Sakidja, Ryan Udan. *Physics, Astronomy, and Materials Science, Missouri State University, Springfield, MO 65897.*

Proximal arteries and distal capillaries have been previously shown to possess different blood flow rates resulting in varying differential hemodynamic forces in wild type embryos*. Thus, there has been a great interest in understanding the molecular mechanisms and signaling pathways that would respond to these hemodynamic forces. Since there has been evidence to indicate a denser accumulation of smooth muscle cells (vSMCs) around the proximal arteries, we are developing a simple physics-based model that would illustrate hypothesized migratory mechanisms of smooth muscle cells toward proximal arteries versus distal capillaries with an initial assumption that the signaling strength is relatively proportional to the magnitude of hemodynamic forces, and by extension, the blood flow rate in the vessels. Through a parametrization of the signal strength, as determined by proximity to the vessels, the model could be fitted to experimental data on the rate of migration and densities of vSMCs as a function of blood flow rate, or possibly vessel diameter. Migrations of vSMCs are quantified and visualized in 3D using this trajectory-tracking model centered around blood vessels of varying flow rate. Different density patterns of migrating vSMCs could possibly be identified, the topology map of which may be utilized further as a complementary diagnostic tool to support experimental analyses.

207. Enhancing lesion targeting in 3-D acoustic radiation force impulse imaging for ultrasound-guided prostate biopsy. Matthew Huber, C. Morris, M.L. Palmeri, K.R. Nightingale. *Physics Department, Rhodes College, Memphis, TN 38112.*

Identification and grading of prostate cancer (PCa) lesions is important to determine a proper treatment plan. A current PCa diagnostic procedure involves transrectal 2-D B-mode ultrasound for identifying potential lesions, and systematic biopsy of the prostate to determine whether cancer is present. The multi-focal nature of prostate cancer, and the difficulty visualizing lesions with ultrasound B-mode, often necessitates 10 or more biopsy samples to determine if a patient has PCa, and even then the extent and severity of the disease may not be fully understood. 3-D acoustic radiation force impulse (ARFI) imaging has demonstrated sensitivity to prostate cancer lesions and their location within the imaged volume. For this study, a graphical user interface was developed to facilitate 3-D ARFI acquisitions in the prostate. Additionally, a 3-D Slicer targeting module was created to relate between positions in the scanned volume to biopsy sampling

locations. Integrating these software tools with ultrasound imaging provided lesion targeting accurate within 2mm during biopsy of a prostate mimicking phantom. This result assists in the translation of 3-D ARFI imaging ultrasound from laboratory investigations to clinical applications.

208. Development of the Fluorino: a low-cost, Arduino-controlled fluorometer. Sam Melhorn, Julie E. C. Gunderson. *Physics Dept., Hendrix College, Conway, AR 72032.*

A fluorometer is a research instrument that is used to measure parameters such as intensity, polarization, and wavelength of fluorescent substances. These parameters are used to identify the presence of specific molecules in a medium, observe conformational changes within species, quantify ligand-receptor binding and dissociation activities, and determine relative distances between locations of biological macro-molecules. Fluorescence spectroscopy is used in many fields including biomedical research, biology, chemistry, biochemistry, biophysics, biomedical engineering, and environmental science. Unfortunately, commercial-grade fluorometers are very expensive and researchers and institutions that do not have the funds to purchase these fluorometers are limited in their research capabilities. The goal of this work is to develop a low-cost, research grade fluorometer capable of measuring intensity, wave-length, and polarization of fluorescent substances. Here in this work we present progress towards the development of an Arduino-controlled fluorometer including a user-friendly selection of stereolithography (STL) files and 3D (CAD) designs that are provided to assist researchers in the building of the Fluorino.

209. Stefan Problem for Radially Symmetric Systems. Paul Niyonkuru, Stepehn Addison. *Physics and Astronomy, University of Central Arkansas, Conway, AR 72035*.

In macroscopic thermodynamics, the variables that we deal with are either extensive or intensive. When we explore nano materials some properties that are extensive on the macro scale are no longer extensive, and as systems get smaller some of the intensive properties become less well defined. We will present the results to date of our investigations of the moving boundary between two phases in both a nano system and a macroscopic system of the same material. This is known as the Stefan problem. The goal of the research is to gain a better understanding of the changeover from a macroscopic system to a nano system. Initial calculations are being made for radially symmetric systems that are gold as there is an extensive literature devoted to the measurement of the properties of gold particle nano systems.

210. Passive Tracking of a Solar Panel with Shape Memory Alloys. Dillon Wester, Keeley Johnson, Angela Douglass. *Physics Department, Ouachita Baptist University, Arkadelphia, AR 71998.*

This experiment seeks to achieve passive tracking of a solar panel through the use of unique metals called shape memory alloys (SMAs). SMAs were configured to rotate a solar panel without the consumption of energy from the solar system because of their ability to change shape when heated above their transformation temperature. The SMA can be activated by sunlight focused from a Fresnel lens. The advantages of SMA over other tracking methods include no maintenance, longevity, and two-way shape memory. The solar panel size, support stand, and electronics were optimized with the ultimate goal of powering an 11 W street light. Experiments were conducted to determine the pulling force and travel of various sizes of SMAs to determine optimal rotor design.

211. Suppression of Radiation-Induced Chromosome Damage by vitamin E Gamma-Tocotrienol. Kassey Cole, Abdel Bachri, Rupak Pathak, and Martin Hauer-Jensen. *Engineering and Physics Department, Southern Arkansas University, Magnolia, AR 71753.*

Ionizing radiation, such as outer space radiation, generates reactive oxygen species (ROS), which causes cytogenetic alterations originating from Chromosome damage. Because antioxidants are potent ROS scavengers, we investigated whether the vitamin E γ-tocotrienol (GT3), a radio-protective multifunctional dietary antioxidant, can suppress radiation-induced cytogenetic damage. We found that GT3 pretreatment reduced double strand break formation in HUVECS, and decreased chromosome aberration in HUVECs after irradiation. Moreover, GT3 increased expression of the DNA-repair gene RAD50 and attenuated radiation-induced RAD50 suppression. We conclude that GT3 attenuates radiation-induced cytogenetic damage, possibly by affecting RAD50 expression. GT3 should be explored as a therapeutic supplement to reduce the risk of developing genetic diseases after radiation exposure.

212. Poster withdrawn.

213. Poster withdrawn.

214. Dynamic Response of Yeast Cells using Automated Microfluidic Devices. Sophia McKinney and Pradeep Kumar, *Engineering and Physics, Southern Arkansas University, Magnolia, AR 71753.*
Temporal regulation of gene expression plays an important role in cellular responses to external stresses. Regulatory pathways ensure that cells are able to respond to temporal environmental changes by regulating the production of various proteins in a time-

dependent manner. While response of cells to steady stress of the environment is widely investigated, the response of the cells to temporal changes in environments such pH, nutrients, and temperature is poorly understood. The amount of information carried by a pathway depends on the bandwidth of the pathway [1,2]. Microfluidic devices are excellent tools in which the flow of different media in micro channels containing cells can be controlled and regulated in a temporal manner and therefore allowing the access to temporal changes in gene expression of various proteins of interest. A microfluidic device will be created using soft lithography. For this, a silicon wafer will be coated in a photoresist (SU8 3010, Microchem USA) to a thickness of 10 µm. It will then be exposed to UV light through a photomask containing the designed channeling in order to cure the parts exposed. Through a developing process, the rest of the photoresist will be etched away resulting in a master mold that will be used to imprint the micro channels on Polydimethylsyloxane (PDMS). This will then be bonded to glass and mounted on a microscope for further experiments. The flow of different media will be controlled using high-pressure reservoirs and pneumatic valves interfaced with an Arduino microprocessor. With this we will use the device to measure cellular responses of budding yeast Saccharomyces Cerevisiae (S. Cerevisiae) with temporal changes in pH. S. Cerevisiae grows better at acidic pH conditions as compared to neutral or alkaline pH; therefore, a media of alkaline pH presents stress to the cells. Recent studies suggest that the alkaline pH sensing in yeast cells is mediated by Slt2 MAPK pathway budding yeast with time dependent phosphorylation of Slt2 upon pH shock [3]. We will use yeast cells where the gene expression level of Slt2 can be monitored upon pH shock of different periodicity in order to quantify the bandwidth of the pathway.

215. Ultrasonic bone assessment using a time domain analysis of backscatter signals from cancellous bone. Phoebe C. Sharp, Jordan P. Ankersen, Joseph A. McPherson, Ann M. Viano, and Brent K. Hoffmeister. *Dept. of Physics, Rhodes College, Memphis, TN 38112.*

Background: Ultrasonic backscatter techniques are being developed to detect changes in cancellous bone caused by osteoporosis. Most techniques analyze backscatter signals in the frequency domain by measuring quantities related to the power spectrum. Goal: Determine if a time domain technique that measures the backscatter amplitude decay constant (BADC) is sensitive to changes in the trabecular microstructure of cancellous bone caused by osteoporosis. Methods: A 3.5 MHz transducer was used to acquire backscatter signals from 54 cube-shaped specimens of human cancellous bone prepared from the proximal end of 14 human femurs. BADC was determined by measuring the exponential decay in the amplitude of the backscatter signal. High resolution x-ray micro-computed tomography was used to measure microstrucutural characteristics of the specimens. Results: BADC demonstrated highly significant linear correlations with trabecular thickness and geometry ($p < 0.001$). Conclusions: Parameters based on a time domain analysis of backscatter signals from cancellous bone may be sensitive to changes in the microstructure of cancellous bone caused by osteoporosis. Funding: NIH/NIAMS R15AR066900.

216. Poster withdrawn.

217. Effect of Cosmic Radiation on Cell Function. Seth Barr, Maria Neal, Azida Walker. *Physics Department, University of Central Arkansas, Conway, AR 72035.* During space exploration, one of the risk factors that needs to be addressed is radiation exposure. Astronauts on the International Space Station are generally exposed to 80-160 mSv throughout their 6-month missions. On average, a human on Earth would be exposed to 1 mSv during this time. As NASA strives for longer missions to the ISS, or even missions to Mars, it becomes even more important to understand the effects of this radiation exposure. With our research, we hope to learn more about how cosmic radiation exposure effects cell function on a molecular level by submitting human cells to low-grade X-ray irradiation, then monitoring the functionality of their calcium channels through the patch clamp method. We present here the calibration of our device to determine similar doses as astronauts in space as well as the initial data for the cell viability.

218. A Glove Design for Quantifiable Rigidity Testing for Parkinson's Disease. Davis Nossaman, Matthew Johnson. *Engineering and Physics, Harding University, Searcy, AR 72143.*

Cogwheel muscle rigidity is one of the prominent motor signs in Parkinson's disease patients. To quantify parkinsonian rigidity, a well-trained movement disorders specialist slowly articulates a patient's joints and rates the perceived level of resistance to the movement on an integer-based scale from 0 (no rigidity) to 4 (severe rigidity) for each joint. The subjectivity of this motor exam leads to intra- and inter- rater variance of rigidity scoring and low scoring resolution, which combine to yield unreliable results regarding the effectiveness of a patient's treatment regime. To address this clinical challenge, we developed a multi-modal sensor glove that integrates an inertial measurement unit and two force sensors attached to the thumb and index fingers. Signals detected from these three sensors were measured through an Arduino system. The glove was evaluated using (1) a phantom elbow joint with variable resistance and (2) a parkinsonian research animal both off and on deep

brain stimulation therapy. The device is lightweight, user-friendly, and capable of examining rigidity across multiple joints, making it a reasonable candidate for implementation in a clinical setting.

219. Decomposition System and Calibrating of a Mass Spectrometer for Propulsion Fuel Analysis. Daniel Mckague, Norman Love, Jonathan Valenzuela, Abdel Bachri. *Engineering and Physics, Harding University, Searcy, AR 72143.*

There is a surge of people creating "green" technologies. This includes green sources of electricity, green fuel to power automobiles, and even green rocket fuel. Right now, the leading fuel for rockets is Hydrazine which is a very dangerous and toxic fuel. When handling hydrazine, you must wear a protective suit or the consequences could be fatal. This has led to a revolution for finding a new type of rocket fuel which can provide a similar specific impulse, which is a quantity that measures rocket performance, and at the same time is also less harmful to people and the environment. Therefore, we have created a system in which we can decompose these new fuels and send their products into a mass spectrometer to analyze. The decomposition system can test multiple pre-heat temperatures, catalytic studies, decomposition rate studies, among other uses. Then after being sent into the mass spectrometer we can determine the concentration of the d ecomposition gasses. Being able to break down and characterize these fuels will help studies in the area design more efficient catalysts.

220. The Raman Detection of Explosives. Bria Collier, Carlton Farley. *Physics and Chemistry, University of Arkansas at Pine Bluff, Pine Bluff, AR 71601.*

The Raman detection explosives is widely unexplored in the United States military. There is motivation to improve current detection systems through testing components of missiles and explosives used in this industry. Thus far, in this study the objectives of this effort are to positively amass the aging effects on weapons propulsion components and provide experimental data and modeling results to allow for potential reduced cost shelf-life projections for propellants/rocket motors. In this research, MNA and ammonium nitrate samples are tested under varied conditions to find ways to improve detection. Raman Spectroscopy is used to identify the elements and gather information regarding the sample. From this data, the best method can be determined to obtain the most desirable results for the development of better detection tools for federal equipment and procedures such as missiles and safety screenings.

221. Modeling Fluid Flow in Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP). Aditya Dendukuri, Tansel Halic, Sinan Kockara, *Computer Science, University of Central Arkansas, Conway, AR 72035* and Ahmadi Shahryar, *Orthopedic Surgery Department, University of Arkansas for Medical Sciences, Little Rock, AR 72205*.

Arthroscopy is a minimally invasive surgical procedure for diagnosis and treatment of a joint. Arthroscopic Rotator Cuff (ARC) is a surgical treatment for group of muscles and tendons that connect the upper arm to the shoulder blade. Our goal is to build a virtual simulation platform named Virtual Arthroscopic Tear Diagnosis and Evaluation Platform (VATDEP) of ARC using various modalities including highly realistic real-time visualization, interactive physics simulation and haptic(touch) devices (robotic devices that can deliver force feedback) in collaboration with University of Arkansas for Medical Sciences. The ultimate goal is to develop a high fidelity platform to train physicians with quantitative performance feedback. One critical aspect of the VATDEP is to model the arthroscopy irrigation solutions and heat flow for electrocautery procedures. Irrigation solutions are mainly used for safety and efficacy during the procedure. Electrocautery is used to clean and remove the ti ssue and prepare the footprint before the placement of anchors at the humeral head. A numerical approach is essential for modeling liquid and heat flow as the medium of fluid flow changes continuously as the simulation progresses. Therefore, we are utilizing a numerical computational technique called Smoothed Particle Hydrodynamics (SPH) to model both heat transfer and liquid simulation. Our formulation intends to virtual simulate complete liquid motion of the irrigation solution and the mechanism of conduction and convection of heat flow within the shoulder cavity in real time. In this work, we present the preliminary results of our unified SPH approach to simulate electrocautery process and liquid flow in the context of ARC surgery.

222. Characteristics of Pattern Recognition Classifiers for EMG Signal Analysis to Improve Prosthesis Control. Shelby Wingate, Kamran Iqbal, Rajat Singh. *Systems Engineering- Mechanical, University of Arkansas – Little Rock, Little Rock, AR 72204.*

Electromyography (EMG) is the recording of electrical signals in muscle tissues, produced when a motor neuron interacts with a muscle fiber. Using classification algorithms to interpret these myoelectric signals is one of the most efficient ways to control lower arm prosthesis for amputees. This study observed and compared two algorithms on the basis of accuracy and processing speed. Multi-Layer Perceptron, an Artificial Neural Network was observed, as well as Linear Discriminant Analysis facilitated through the BioPatRec

research platform on Matlab. The algorithms were trained on data available on the BioPatRec repository, classifying 4 different hand movements. Pre-processing of the data involved filtering the signals using independent component analysis and contraction time percentage. Both algorithms performed adequately with impressive accuracies of 97.4% for Linear Discriminant Analysis and 98.3% for Multi-Layer Perceptron.

223. Virtual Reality Applications for Simulations in Carbon-Based Nanocomposites. Christopher J. Robledo, Ridwan Sakidja. *Physics Department, Missouri State University, Springfield, MO 65897.*

We are developing a new Virtual Reality (VR) visualization platforms that utilize UNITY and BLENDER codes with the help of Molecular Dynamics simulation LAMMPS code to depict a variety of dynamic molecular events at the atomistic scale. Two main aspects that we examined are the deformation mechanisms and oxidation reactions of carbon-based nanomaterials. By utilizing these visualization apps, step-by-step mechanisms of the mechanical and chemical degradation processes can be further analyzed and be used as an effective diagnostic tool to enhance the physical properties of the nanomaterials in general.

224. Effect of Hind-Limb Suspension and X-Ray Irradiation on the Mechanical and Chemical Properties of Rat Femur and Tibia Bones. S.G. Freyaldenhoven[1], B. Hill[2], R. Mehta[1], J.S. Barajas[1], H.N. Heacox[1], M. Dobretsov[3], P. Chowdhury[4]. *1Department of Physics & Astronomy, University of Central Arkansas, Conway, AR 72035 2Department of Biology, University of Central Arkansas, Conway, AR 72035 3Department of Anesthesiology, University of Arkansas for Medical Sciences, Little Rock, AR 72205 4Department of Physiology & Biophysics, University of Arkansas for Medical Sciences, Little Rock, AR 72205.*

It is known that space conditions such as microgravity and cosmic radiation have detrimental effects on the skeletal system of humans, such as decreased bone mineral density. This research studies the changes in mechanical properties, elasticity, and chemical properties, calcium and phosphorus content, of rat femur and tibia bones when exposed to hind-limb suspension and x-ray irradiation, simulated microgravity and cosmic radiation. It is hypothesized that if microgravity and cosmic radiation lead to decreased bone mineral density, then these conditions will produce weakened bones, lower elastic moduli and abnormal concentrations of calcium and phosphorus, as compared to bones not subject to these conditions. A technique known as three-point bending was employed to estimate the Young's (elastic) modulus for the leg bones. To investigate the chemical nature of the bones, a Scanning Electron Microscope (SEM) was utilized to take cross-sectional images and to perform energy dispersive x-ray spectroscopy. Ultimately, the results produced by this research will aid in quantifying the effects of spaceflight and may be used in developing a treatment to counteract such effects. †This work supported by a RID and CRP grant from Arkansas Space Grant Consortium.

225. Raman Spectroscopy and SERS of Methyl-thioninium Chloride in Solution. M.R. Shattique. *Physics Department, Missouri State University, Springfield, MO 65897.*

Raman spectroscopy is a powerful technique that can provide compound specific information about vibrational dynamics. The development of Raman instrumentation having high light throughput, equipped with high performance CCD detectors, the use of optical microscopes to focus the laser on the sample and collect the scattered radiation, and the notch filter technology caused a tremendous increase in the use of Raman spectroscopy as an analytical tool. In this research we did Raman scattering characterization of liquid solutions of important reduction-oxidation indicator methylthioninium chloride C16H18ClN3S, also known as methylene blue. We used two excitation wavelengths, 523nm and 714 nm, to characterize our liquid samples. Appropriate focusing of the laser was found to be an important factor in these experiments. With proper focusing, strong Raman spectra of methylene blue were obtained. The most pronounced bands that we have observed correspond to C-C bond stretching of the aromatic ring at 1624 cm-1; vibrations of CN bonds and CH3 groups between 1397 cm-1 and 1468 cm-1; and C-N-C skeletal bending at 500 cm-1 and 437 cm-1. We also observe Raman bands between 772cm-1 and 854 cm-1, origin of which we are currently identifying. We are also doing surface enhanced Raman spectroscopy (SERS) of methylene blue using gold coated glass slides as substrates. The SERS effect was confirmed by an increase of intensity of certain Raman peaks.

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Rice, Lindsey	A	31
Roark, Casey	A	24
Robledo, Christopher	A	223
Robleto, Valeria	B	54
Roldan, Rebeca	A	115
Rostollan, Mason	B	10
Salazar, Paloma	A	112
Sanchez, Fernanda Hernandez	B	105
Sanders, Emily	B	102
Seminara, Emily Joy	A	105
Senn, Rachel M.	A	119
Shaddox, Sage	A	50
Sharabura, Anna	A	17
Sharp, Phoebe	Oral Physics	4:20, A 215
Shattique, M R	A	225
Sieczkowski, Amanda	A	7
Simeon, Jodi	B	16
Simpson, Hannah	A	123

Sites, Jacey	A	19
Smith, Lane	B	53
Smith, Lane Smith	A	54
Spivey, Reed	A	205
Stone, Emily Taylor	A	11
Szwedo, Sylvia	B	31
Taylor, Nathan	A	116
Tedford, Blake	B	28
Terry, Nathan	B	39
Tolar, Joe	Oral Biology	3:20
Tran, Emily N.H.	B	119
Tunc, Mustafa	B	50
Underwood, Jesse	A	203
Veluvolu, Manasa	B	19
Weber, Hannah	A	22
Wester, Dillon	A	210
Whaley, Madison	B	120
White, Makala	A	6
Winfrey, Mercedes	Oral Physics	3:35
Wingate, Shelby	A	222
Woller, Sarah	B	45
Woodall, Aaron	A	21
Woody, Audrey	A	102
Wynn, Allie	B	46
York, Alxandr Kane	B	7
Zong, Guanghui	B	114

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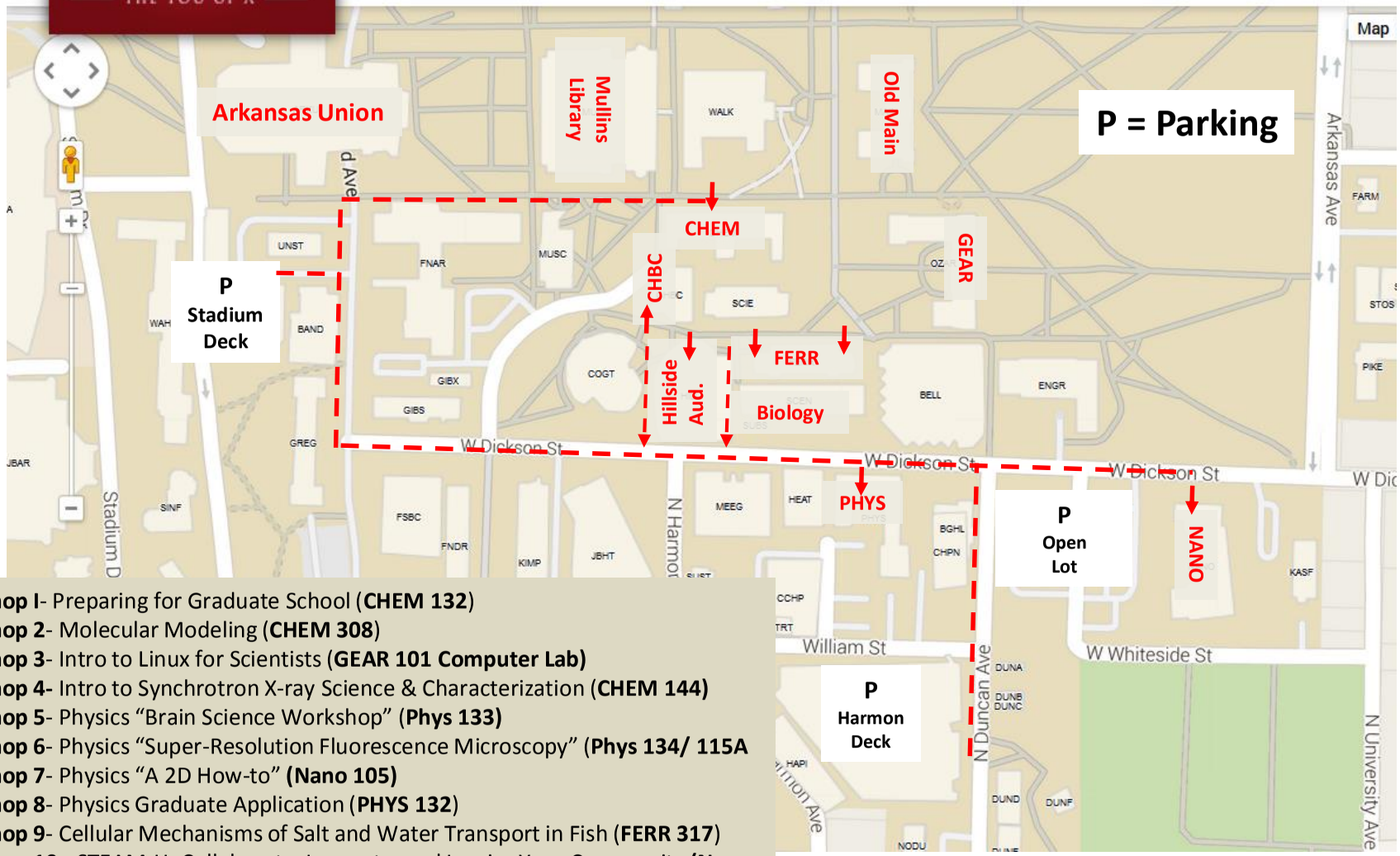
INBRE Workshops: 10:30-11:45



Workshop I- Preparing for Graduate School (**CHEM 132**)
Workshop 2- Molecular Modeling (**CHEM 308**)
Workshop 3- Intro to Linux for Scientists (**GEAR 101 Computer Lab)**
Workshop 4- Intro to Synchrotron X-ray Science & Characterization (**CHEM 144)**
Workshop 5- Physics "Brain Science Workshop" (**Phys 133)**
Workshop 6- Physics "Super-Resolution Fluorescence Microscopy" (**Phys 134/ 115A**
Workshop 7- Physics "A 2D How-to" **(Nano 105)**
Workshop 8- Physics Graduate Application (**PHYS 132**)
Workshop 9- Cellular Mechanisms of Salt and Water Transport in Fish (**FERR 317**)
Workshop 10 - STEAM-H: Collaborate, Innovate, and Inspire Your Community **(Nano Atrium)**